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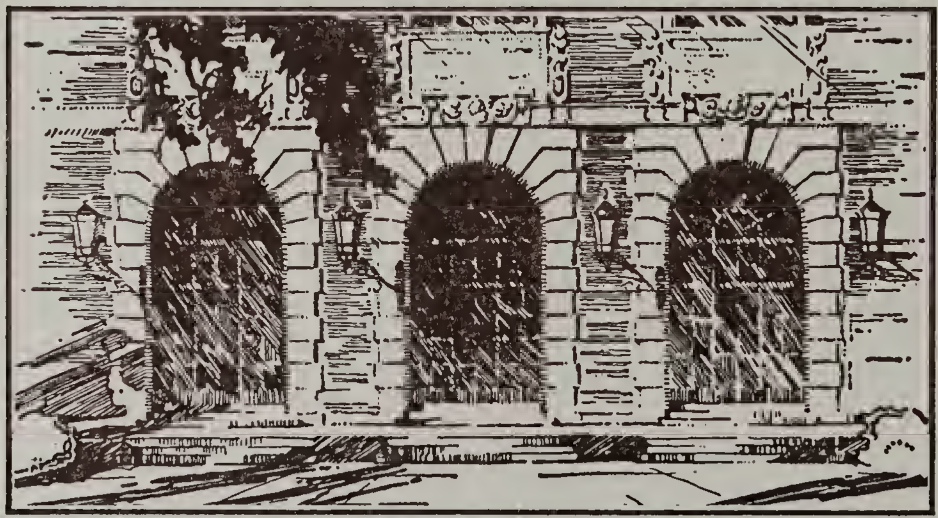

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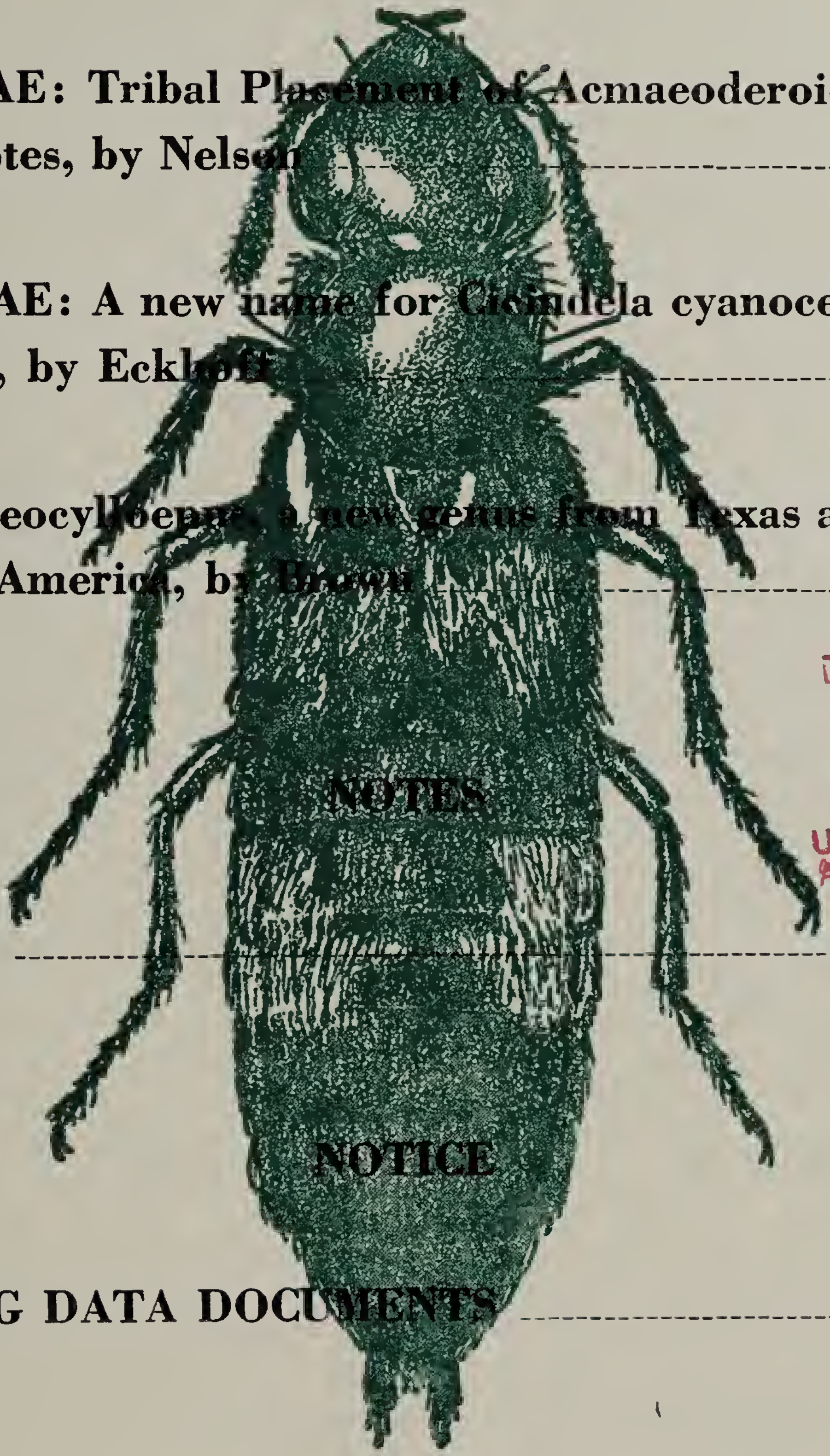

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DEPARTMENT of ENTOMOLOGY
Purdue University – Lafayette, Indiana

THE COLEOPTERISTS' BULLETIN

Founded 1947 by Ross H. Arnett, Jr.

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The Coleopterists' Bulletin

A QUARTERLY PUBLICATION DEVOTED TO THE
STUDY OF BEETLES

VOLUME 24, 1970

DEPARTMENT of ENTOMOLOGY
PURDUE UNIVERSITY
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THE COLEOPTERISTS' BULLETIN

VOLUME 24 MARCH 1970 NUMBER 1

3.0001 *Neocylloepus*, A New Genus From Texas and Central America (Coleoptera: Dryopoidea: Elmidae)

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STOVALL MUSEUM OF SCIENCE AND HISTORY AND
DEPARTMENT OF ZOOLOGY
THE UNIVERSITY OF OKLAHOMA
NORMAN, OKLAHOMA 73069
U. S. A.

INTRODUCTION

In 1882, Sharp described a new elmid species from Guatemala under the name *Elmis sculptipennis.* His description was based upon " . . . a single, rather immature individual," collected by Champion from the Rio Naranjo. After examining this type specimen at the British Museum (Natural History) and studying eleven additional specimens he had collected in central Mexico, Hinton (1940) redescribed the species under the name *Cylloepus sculptipennis* (Sharp). He pointed out that the genus *Elmis,* as now restricted, is confined to the Old World. He also clarified and redefined the genus *Cylloepus,* describing the larva and some new species. His larval description was based upon two specimens from Mexico and one from Bolivia. Bertrand (1955) presented a figure of the entire larva—presumably that of *C. montanus* Grouvelle—drawn from specimens collected by Meinert in Venezuela in 1891 and preserved in the Zoological Museum of Copenhagen.

Upon working through my own dryopoid collections, I find that I have, among several hundred specimens of *Cylloepus,* a total of 142 adult specimens readily identifiable in Hinton's key as *C. sculptipennis.* Geographically they range from Devil's River, Texas (south of Juno) to the Isthmus of Panama. Although this represents a considerable extension of the known distribution, my interest was focused upon them because of a new type of larva which was associated with them. Ninety-one specimens of this larva were taken in collections with these adults all the way from Texas to the Isthmus of Panama, only four such larvae being taken in the absence of such an adult (adults were collected a few miles away). The larvae were of appropriate size to produce these adults, and no other "contenders" were present (i.e., genera for which the larval types were unknown). I had little choice but to conclude that these larvae were the immature stages of *"Cylloepus" sculptipennis,* despite the fact that they were quite unlike the larvae heretofore attributed to *Cylloepus.* My initial surmise was that perhaps Hinton and Bertrand had been mistaken in identifying their larvae as those of *Cylloepus,* since their larval type was strikingly different from the larvae of such presumed closely related genera as *Elsianus* and *Stenelmis,* whereas my new larvae were obviously very similar to both of these. However, the fact that my specimens were so unlike the larvae reasonably attributed to *Cylloepus* forced me to make a careful examination of the adults. This examination, in turn, revealed the fact that the group under consideration simply represents a distinct genus—one which is apparently closer to several other genera, in fact, than to either *Elmis* or *Cylloepus.*

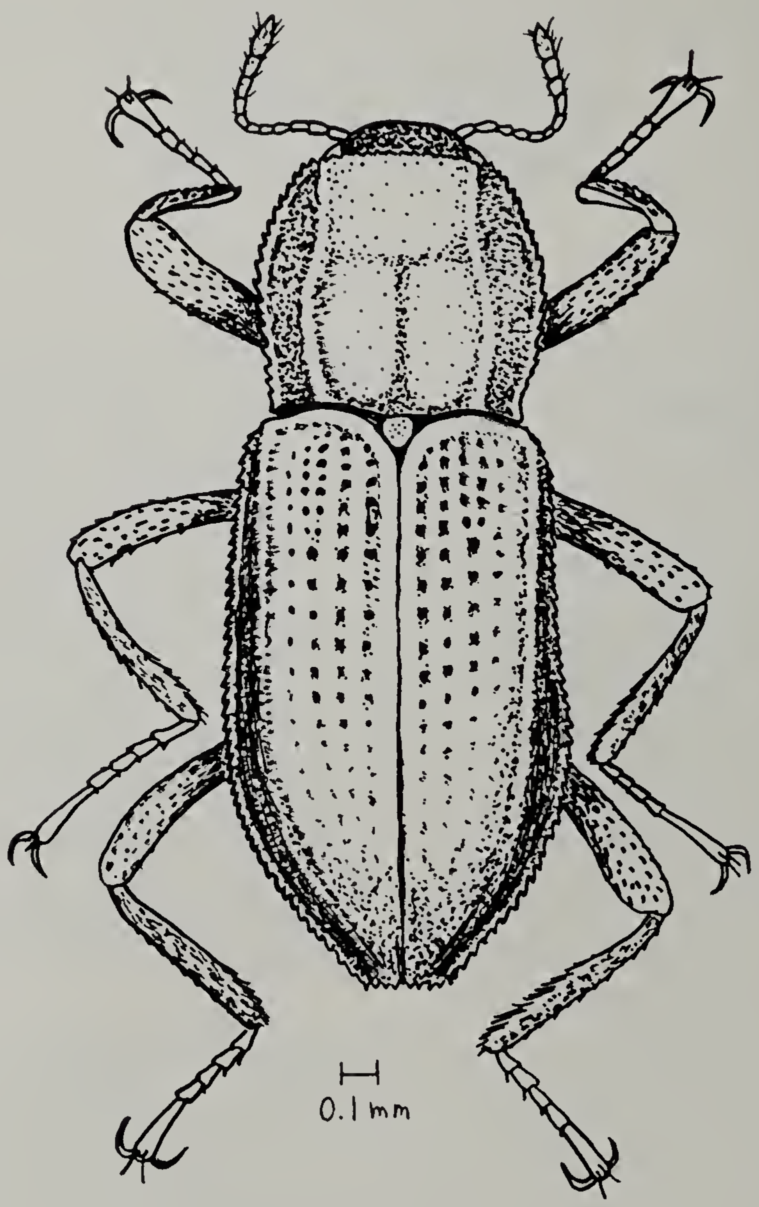

Fig. 1. *Neocylloepus sculptipennis* (Sharp). Adult to show general appearance. Drawn from specimen collected near Somoto, Nicaragua.

Neocylloepus, New Genus

Body elongate, subparallel, moderately convex (Fig. 1). Dorsal surface covered with short, fine, recumbent, brownish hairs which are relatively sparse. Tomentum confined to genae, sides of sterna, sternites (except in center of first and sometimes second sternites, epipleura, and legs except tarsi (sparse on trochanter and tibia).

Head completely retractable, with lateral notch in prothorax at anterior margin of notopleural suture to accommodate antenna. Antenna 11-segmented, approximately the same length as the pronotum. Labrum transverse, slightly arcuate apically; angles broadly rounded with both blunt and pointed bristles (Fig. 2). Mandible with three subacute apical teeth; with an anteriorly directed ventrolateral lobe; prostheca large, membranous, with hairy margin and spiny apex (Fig. 3). Maxillary palp 4-segmented, galea palpiform, 2-segmented, with apical and lateral spines, and almost as long as palp; lacinia with prominent spines forming a mesial row and an apical brush (Fig. 6). Labial palp stubby, 3-segmented, with only the terminal segment longer than broad; ligula with short, rather blunt spines near apex on each side (Fig. 5). Mentum transverse, not quite as broad or as long as submentum; gula posteriorly much narrower than submentum.

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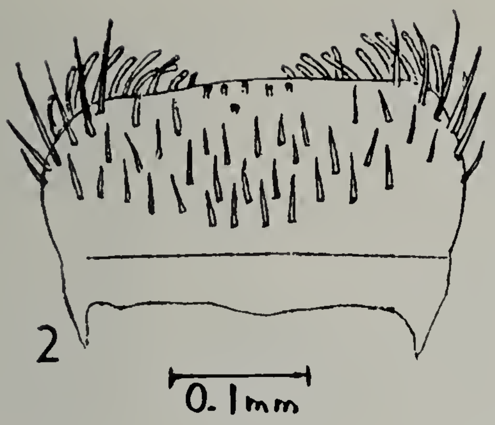

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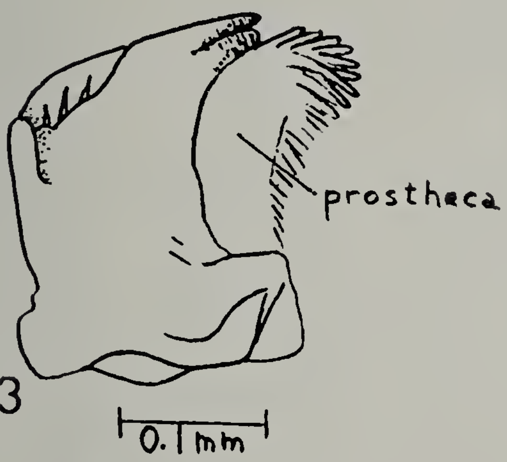

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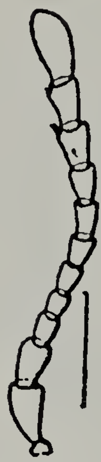

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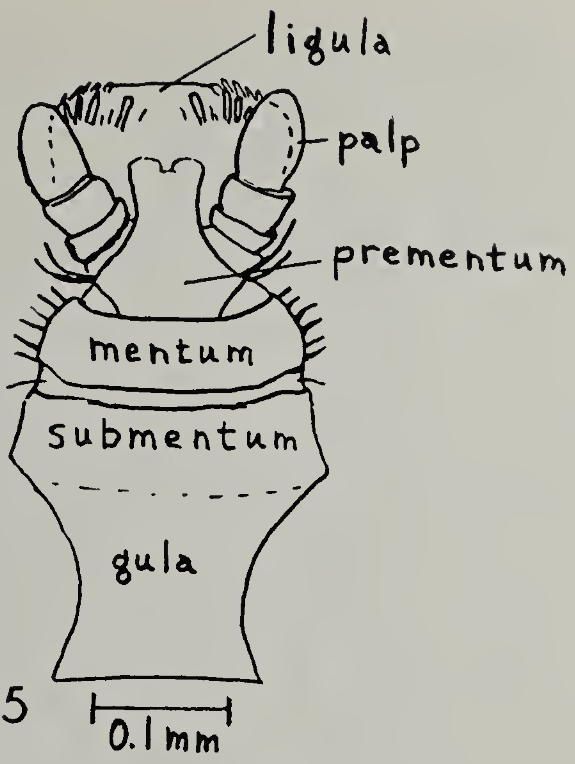

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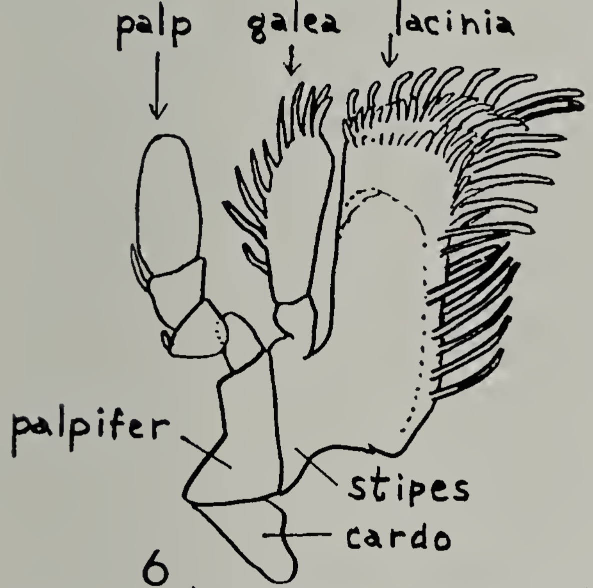

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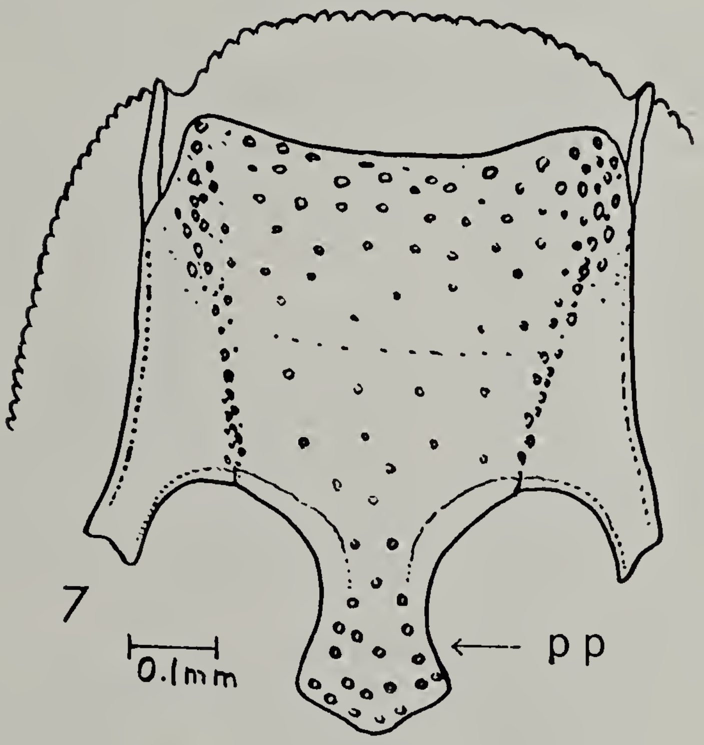

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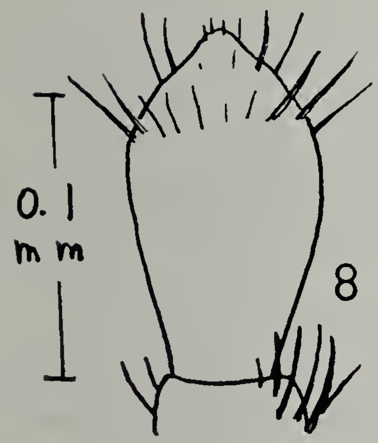

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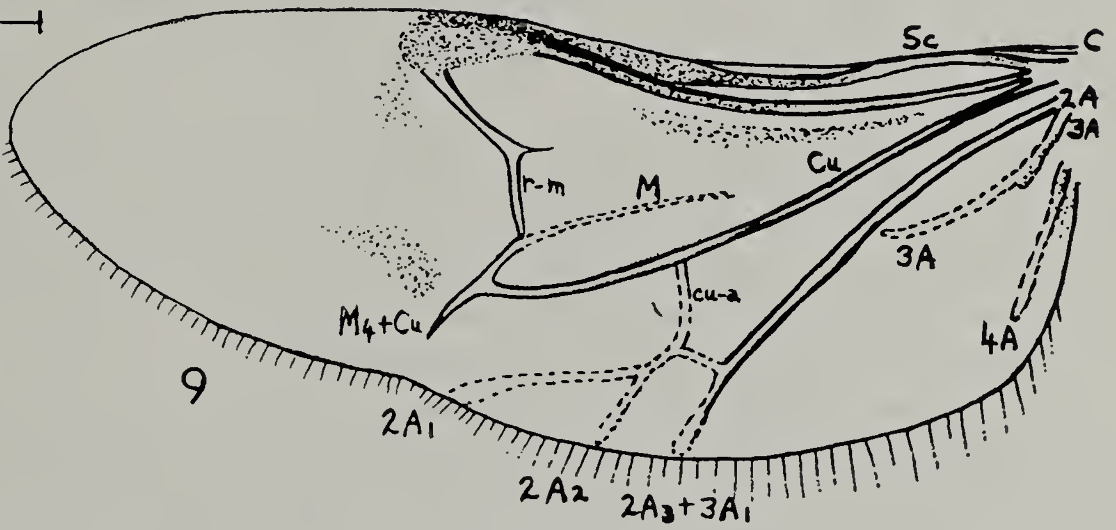


Fig. 2. Labrum of adult female *N. boeseli* sp. n., dorsal aspect.

Fig. 3. Mandible of adult female *N. boeseli* sp. n. The third apical tooth, which is subacute, is hidden by the outer tooth.

Fig. 4. Antenna of *N. hintoni* sp. n. Scale line—0.2 mm. (From Hinton, 1940.)

Fig. 5. Labium of adult female *N. boeseli* sp. n., ventral aspect.

Fig. 6. Right maxilla of adult female *N. boeseli* sp. n., ventral aspect.

Fig. 7. Prosternum of adult female *N. boeseli* sp. n. (*pp*—prosternal process).

Fig. 8. Apical antennal segment of adult female *N. sandersoni* sp. n.

Fig. 9. Wing of *N. boeseli* sp. n. to show venation.

Pronotum with a sublateral longitudinal carina on each side extending from base to apex; with a median longitudinal impression extending from base three-fifths of the distance toward anterior margin. This impression, which is usually widest at the base, terminates in a transverse impression which is quite discrete in some specimens but very obsolete in others. The pronotum is broadest at about basal two-fifths, at which point it is approximately as broad as long; broader at base than at apex.

Elytra striate and punctuate; without apparent accessory striae or with an accessory stria at base of third; with one sublateral carina but no other conspicuous elevations. Hind wing without radial cross vein or anal cell; first anal absent; second anal with three branches, joined to cubitus by cubitoanal crossvein; third anal without a branch (or with a slight vestige of one) and sometimes not quite attaining second anal; fourth anal well developed; medial before junction with radiomedial crossvein present but obsolete; subcosta may fuse with costa near base as well as distally (Fig. 9).

Prosternum very long in front of procoxae; prosternal process long, slightly dilated toward apex (Fig. 7). Mesosternum with a deep groove for reception of prosternal process. Metasternum with a median longitudinal impressed line. First abdominal sternite with a median depression bounded laterally by a tuberculate longitudinal carina on each side. This depression occupies virtually all the space between the metacoxal cavities. Posterolateral margin of fifth abdominal sternite prolonged on each side to form a dorsally projecting tooth which engages a slight notch at the apical end of the elytral epipleura, serving to hold the elytra firmly against the abdomen. Legs with the visible portion of the procoxae rounded and trochantin completely concealed by the epimeron and episternum. Claws without teeth.

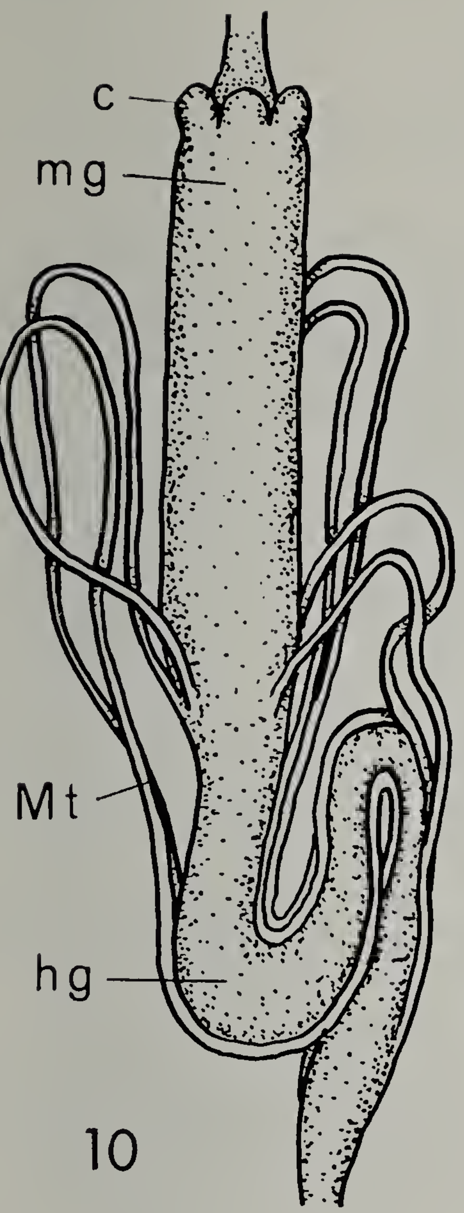
Alimentary canal with six caeca on the anterior margin of the midgut (Fig. 10). As nearly as I can tell, there are six Malpighian tubules, two arising from each side and two ventrally. Those on the left extend anteriorly fully half the length of the midgut, then loop and return to the hindgut where they lie attached to or partially embedded in the wall of the gut throughout most of its descending loop (on the outside) and all of its ascending loop. The two Malpighian tubules on the right also first pass anteriorly, but usually not as far as those on the left, then return to become attached to the wall of the rectum (Fig. 10). The remaining pair, after passing anteriorly, returns to extend along the inner margin of the descending loop of the hindgut and the outer margin of the ascending loop, terminating. on the ventral wall of the rectum. (The material at hand is not ideal for dissection, and I have had considerable difficulty making out this much detail. It is possible that there are additional, even more fragile tubules which I have been unable to trace.)

Central nervous system (Fig. 13) with three discrete thoracic ganglia, the first being largest and broadest and connected to the subesophageal ganglion by a very short double cord. The paired cords are distinctly separated in the thoracic region, apparently fused in the abdominal. The first abdominal ganglion is almost fused with the third thoracic; the second, third, and fourth abdominal ganglia are free; the fifth, sixth, seventh, and eighth are fused into a single elongate tear-shaped ganglion.

Male reproductive system (Fig. 14): each testis composed of two ovoid or saccate sperm tubes; vasa efferentia short and inconspicuous; lateral descending portion of vas deferens mildly convoluted, loop and ascending portion enlarged to form an elongate tubular seminal vesicle; median lateral accessory glands small, saccate, dorsal, directed posteriorly; lateral accessory glands relatively large, bulging posterolaterally, forming a tight coil anteromedially. Male genitalia (Figs. 23-34) of the trilobate type characteristic of dryopoids, the basal piece decurved and distinctly longer than the penis or parameres.

Fig. 10. Alimentary tract of adult *N. boeseli* sp. n., dorsal aspect. Only three of the six caeca at the anterior margin of the midgut are visible. Key to abbreviations: *c*—caecum, *hg*—hindgut, *mg*—midgut, *M t*—Malpighian tubule.

Fig. 11. *N. hintoni* sp. n. Adult to show general appearance. (From Hinton, 1940.)



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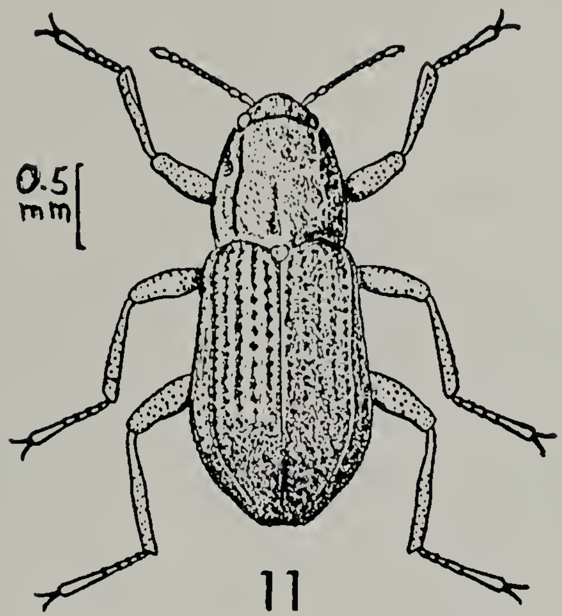

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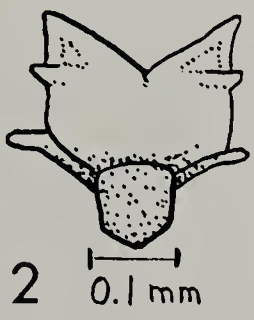

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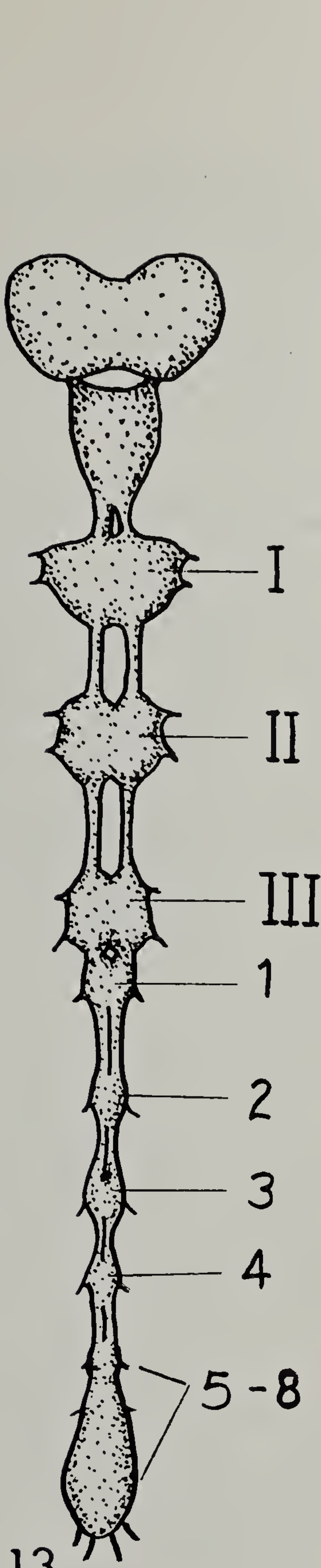

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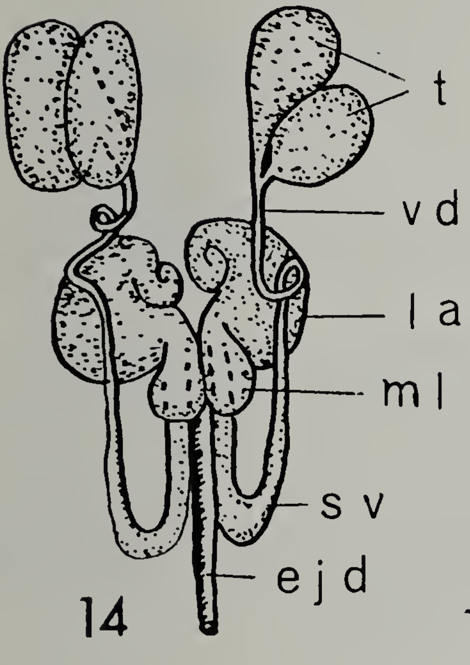

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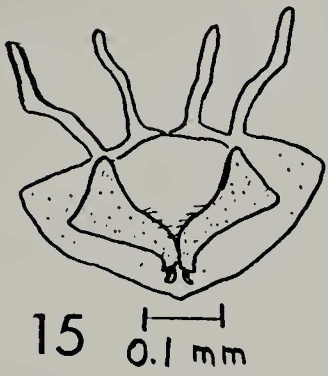

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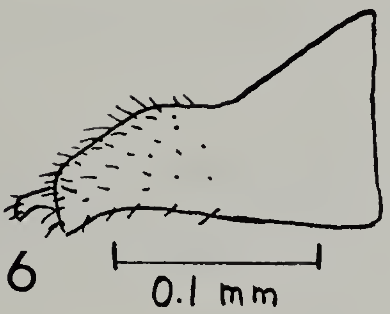

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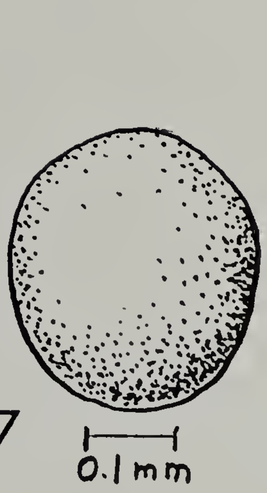

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Fig. 12. Scutellum of *N. sculptipennis* (Sharp) from Somoto, Nicaragua. Only the lower pentagonal portion of the figure is externally visible and described in the text.

Fig. 13. Central nervous system of adult *N. boeseli* sp. n. Thoracic ganglia are indicated by Roman numerals, abdominal ganglia by Arabic numerals.

Fig. 14. Male reproductive system of *N. boeseli* sp. n., dorsal aspect. Key to abbreviations: *t*—lobes of testis, *v d*—vas deferens, *l a*—lateral accessory gland, *m l*—median lateral accessory gland, *s v*—seminal vesicle, *ej d*—ejaculatory duct.

Fig. 15. Female genitalia of *N. boeseli* sp. n., dorsal aspect.

Fig. 16. Enlarged view of right stylus (coxite) of female genitalia of *N. boeseli* sp. n., dorsal aspect.

Fig. 17. Egg of *N. boeseli* sp. n., dorsal aspect.

I am uncertain as to some details of the female reproductive system, since virtually every specimen dissected was distended with eggs (Fig. 19), as many as 17 large eggs (Fig. 17) being present in a single specimen. Two egg tubes were detectable in each ovary of the specimen figured, but perhaps others were already emptied and no longer apparent. In the only female dissected which was not so distended (Fig. 18), there were four egg tubes visible in the right ovary but only three in the left. The spermatheca is convoluted, the spermathecal gland inconspicuous and elongate. I have not found a distinct bursa copulatrix; either the spermatheca opens directly into the vagina or perhaps the posterior portion of what I consider the spermatheca is actually a bursa. The female genitalia (Figs. 15, 16, 19-21) are inconspicuous and delicate.

The most conspicuous secondary sexual characters are those mentioned by Hinton (1940):

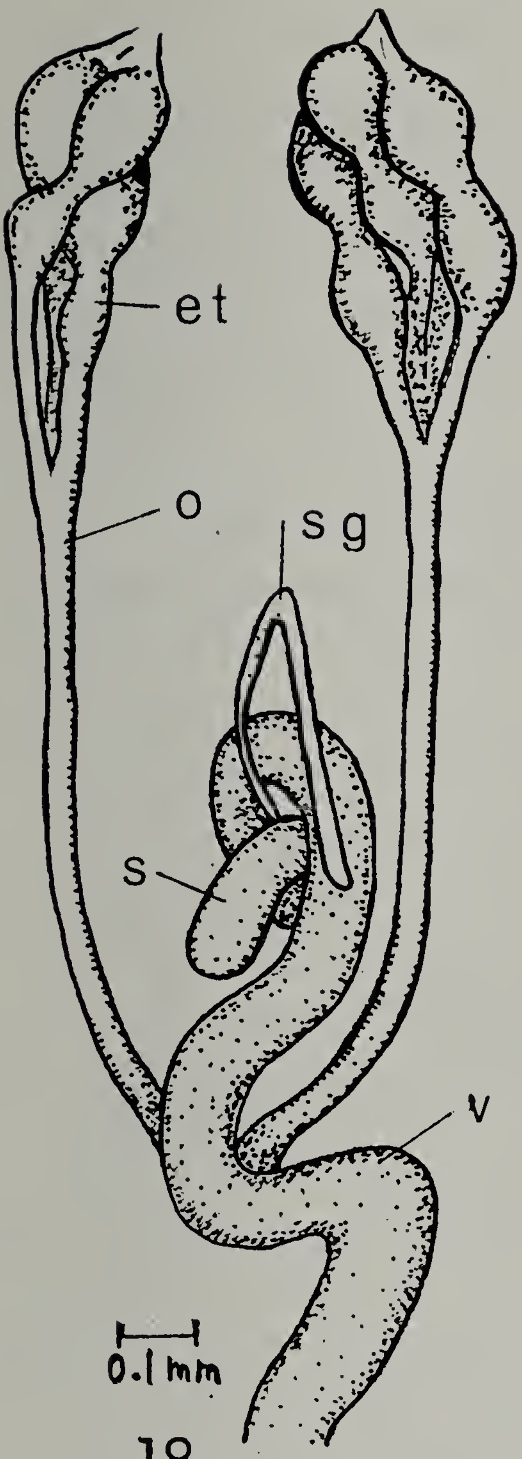
1. the carinae of the first abdominal sternite of the male are usually curved, as if to enclose the median depression, whereas the carinae of the female are typically straight and parallel;
2. the carinae of the male usually extend to the posterior margin of the first sternite, where they are often most prominent; those of the female usually terminate farther forward and are least prominent apically;
3. the median depression of the male usually extends onto the second sternite, whereas that of the female is confined to the first sternite.

I would add the following: the carinae of the prosternum which extend anteriorly from the procoxal cavity are more prominent in the male. In any given locality, the females are generally larger than the males.

GENOTYPE: *Neocylloepus sculptipennis* (Sharp, 1882)

Externally, this genus seems very close to *Cylloepus* Erichson (1847). From *Cylloepus* it differs significantly in the following respects:

1. It has but one sublateral elytral carina. The presence of two may now be considered characteristic of **Cylloepus.**
2. There is a short accessory stria at the base of the third elytral stria. (Perhaps this is not a generic feature. Hinton did not mention or figure it, but all of my specimens in which the striae are discernable seem to exhibit it.)
3. The basal piece of the male genitalia is distinctly longer than the penis or parameres.
4. In the female, each ovary has no more than four egg tubes rather than about eighteen.
5. The fifth abdominal ganglion is fused with the sixth, seventh, and eighth; in **Cylloepus** as figured by Hinton (1940), it is free.
6. In wing venation, the subcosta is often fused with the costa near the base, there is a considerable vestige of the median, and the third anal vein does not have a second branch and sometimes does not fuse with the second anal.
7. There are six, rather than eight, gastric caeca.
8. The larva (Figs. 35-50) is strikingly different, being much more like that of **Elsianus, Microcylloepus,** or **Stenelmis** than like that attributed to **Cylloepus** by Hinton (1940), Bertrand (1955), **et al.** Among the ways in which this larva differs from that of **Cylloepus** are the following:
    a. the thoracic pleurae are divided;
    b. there is no posterior median prosternal suture;
    c. the first abdominal segment has both tergo- and sterno-pleural sutures;
    d. abdominal segments eight and nine without lateral sutures;
    e. the tergo- and sterno-pleural abdominal sutures converge terminally;
    f. tergo-pleural thoracic sutures are present.



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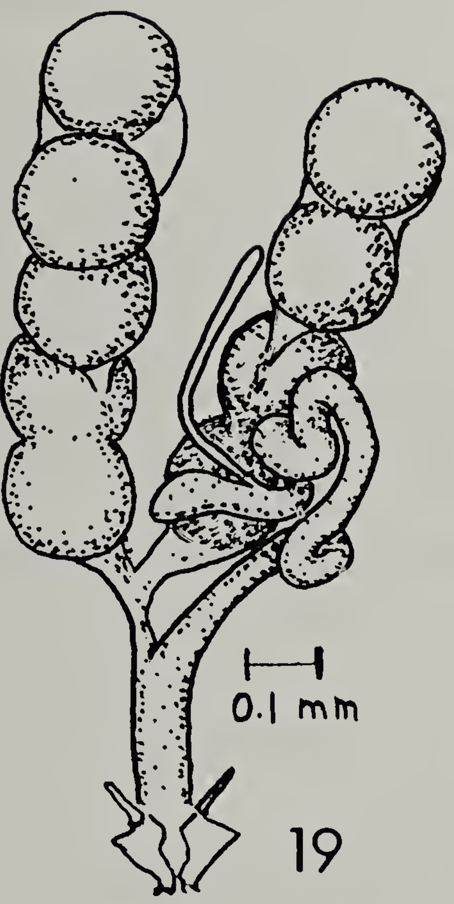

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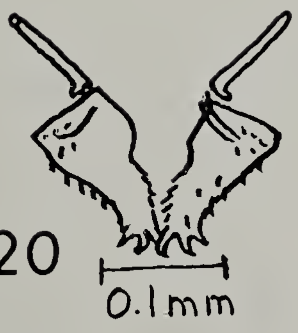

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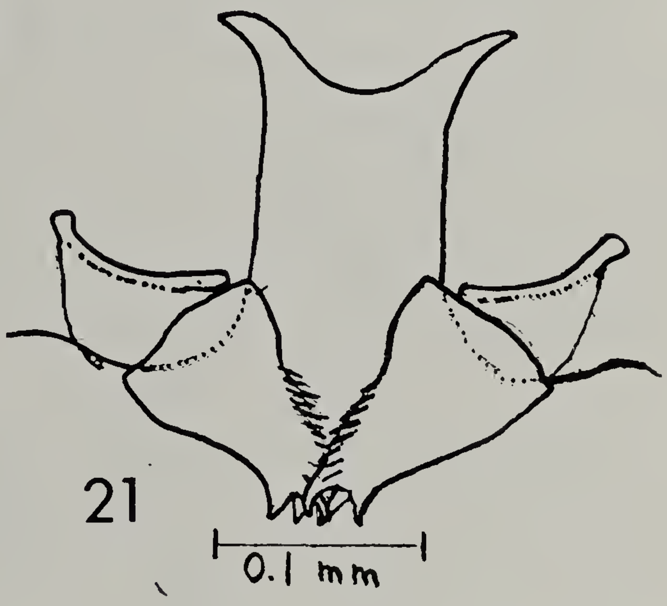

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Fig. 18. Female reproductive system of *N. boeseli* sp. n., dorsal aspect. This specimen, collected in May, was the only female dissected in which the ovaries were not excessively distended with eggs. The left ovary consists of three egg tubes, of which only two can be seen; the right ovary has four egg tubes, of which only three are visible. Key to abbreviations: *e t*—egg tube of ovary, *o*—lateral oviduct, *s*—spermatheca, *s g*—spermathecal gland, *v*—vagina.

Fig. 19. Female reproductive system of *N. sculptipennis* (Sharp), dorsal aspect. On the left, the anterior three eggs are in one egg tube, the posterior two in another. On the right, the anterior two are in one egg tube, the others in another. In such specimens, some of which have many more eggs, it is difficult or impossible to determine the number or location of the egg tubes.

Fig. 20. Enlarged view of female genitalia of *N. sculptipennis* (Sharp), dorsal aspect.

Fig. 21. Female genitalia of *N. sandersoni* sp. n., dorsal aspect.

Neocylloepus is perhaps closest to *Heterelmis* in wing venation (Fig. 9) and in some details of mouthparts. Its digestive tract also resembles that of *Heterelmis* and that of *Hexacylloepus* in having only six gastric caeca. From both of these it differs in many respects, including the possession of but one sublateral elytral carina. Taking all factors into consideration—internal, external, and larval characters—*Neocylloepus* is probably closest to *Hexacylloepus.*

In the keys of Hinton (1940), adults of *Neocylloepus* key out to *Cylloepus* (but do not fit the description given in the key), larvae to *Elsianus.* In the keys of Leech and Chandler (1963), adults of *Neocylloepus* do not fit the key but would almost run either to *Neoelmis* or to *Microcylloepus;* larvae would most nearly key out to first instars of *Microcylloepus,* but recognizing that mature larvae should not go here, one might key them to *Elsianus.* Arnett's (1963) key is taken from Leech and Chandler's key to adults. In the keys of Leech and Sanderson (1959), adults of *Neocylloepus* key out to *Microcylloepus,* larvae to *Elsianus.* In Bertrand's (1955) larval key, specimens of *Neocylloepus* would probably be identified as either *Elsianus* or *Neoelmis,* although they would not quite fit either set of characters.

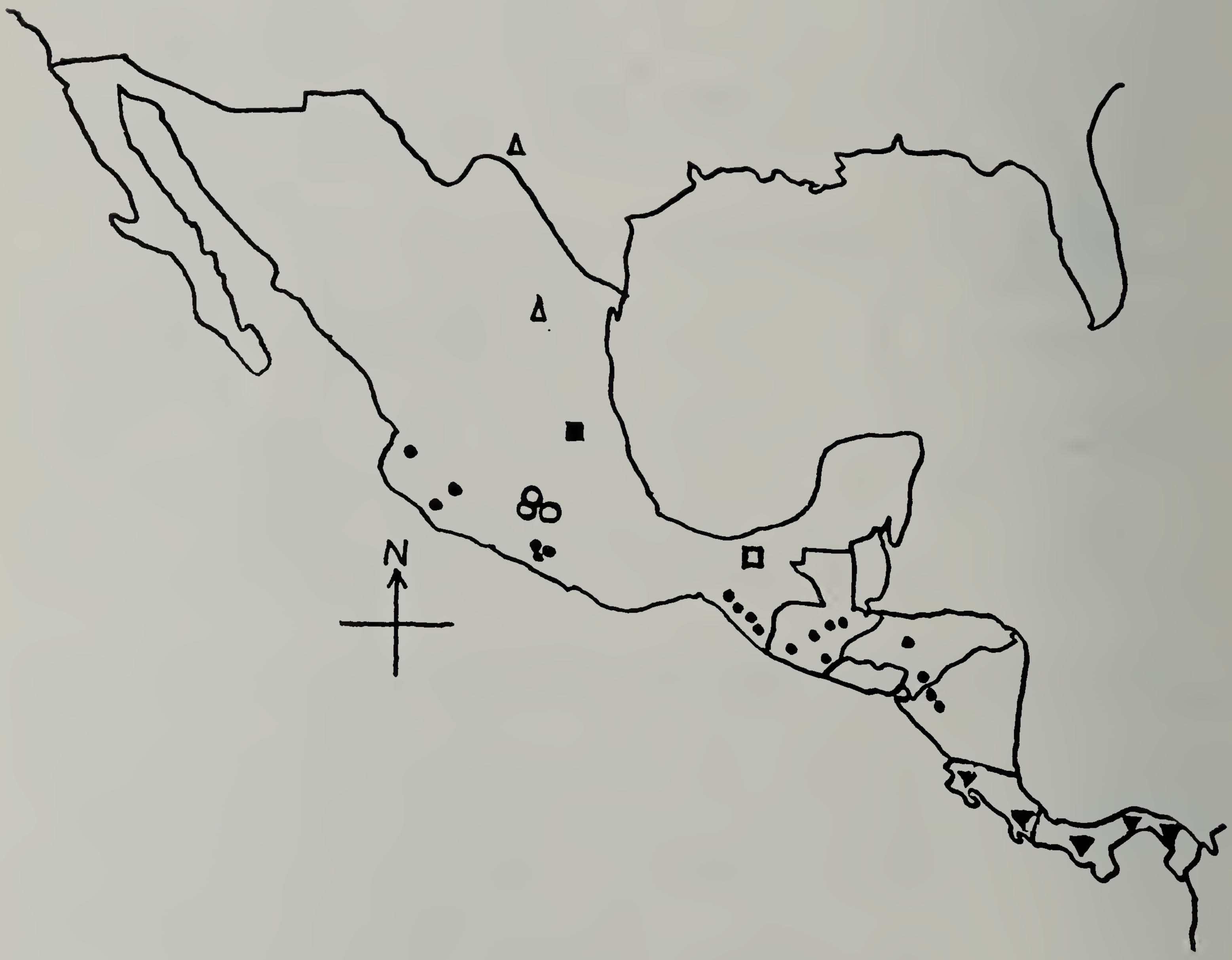


Fig. 22. Distribution map showing localities in which the various species of *Neocylloepus* gen. n. have been collected. *N. arringtoni*—■; *N. boeseli*—△; *N. hintoni*—○; *N. petersoni* —□; *N. sandersoni*—▼; *N. sculptipennis*—●

Since *Neocylloepus* occurs from Texas to Panama (Fig. 22), it is appropriate to indicate where and how it may be inserted in existing keys to the elmids of both the United States and Mexico (no keys exist for the rest of Central America).

KEYS TO GENERA: ADULTS

In the key provided by Leech and Sanderson (1959), on page 1004, replace couplet 98 with a dual couplet as follows:

98a (97) Each mandible (Fig. 38-47) with a narrow lobe on lateral margin 98c
98b Mandible without narrow lateral lobe 100
98c (98a) Each elytron with one sublateral carina; pronotum without oblique sculpturing, but posterior half divided by a median longitudinal furrow .... (1 species) .... **Neocylloepus** Brown
98d Each elytron with two sublateral carinae (rarely one in **Microcylloepus,** which has oblique sculpturing on posterior half of pronotum) 99

In the key of Leech and Chandler (1963), on page 362, replace couplet 20 and add couplet 24 as follows:

20 Each elytron with one sublateral carina; pronotum with oblique sculpturing 24
— Each elytron with two sublateral carinae (rarely only one in **Microcylloepus,** which has oblique sculpturing on posterior half of pronotum) 21
24 Pronotum undivided except by a transverse impression at anterior two-fifths (Fig. 13.55a) .... **Neoelmis** Musgrave, 1935
Neoelmis caesa (LeConte) 1874; 1.6 mm.; testaceous; Texas and Oklahoma
— With transverse impression as above, but also with posterior half of pronotum divided by a median longitudinal impression or furrow .... **Neocylloepus** Brown, 1970
Neocylloepus boeseli Brown 1970;2.55-3.2 mm.; brown; Devil's River, Texas

The adaptation of the key of Leech and Chandler (1963) given above will also serve for that of Arnett (1963), page 477, or Fascicle 42:4, except for the reference to the figure. In Hinton's (1940) key to the genera of Mexican Elmini, page 227, change the second part of couplet 3 to read:

> "Elytron without accessory striae, or with one at base of third stria (**Neocylloepus** Brown). Each testis composed of one or two sperm tubes .... 4"

Also, on pages 228-229, replace couplets 7 and 8, and add couplet 11, as follows:

7. Each elytron with two sublateral carinae (rarely only one in **Microcylloepus,** in which case, basal half of pronotum with an oblique impression on each side) 8
Each elytron with only one sublateral carina; without oblique impressions on pronotum 11
8. Pronotum on apical two-fifths with a moderately deep, occasionally incomplete, transverse impression; with a median longitudinal discal impression; on basal half on each side with an oblique impression. Hypomera with tomentum. Alimentary canal with two caeca on the anterior margin of the midgut; hindgut with six Malpighian tubules. Each ovary with six egg tubes. Central nervous system with the first three abdominal ganglia discrete ....NORTH and SOUTH AMERICA ....**Microcylloepus** Hinton (1935)
Pronotum without transverse impression on apical two-fifths. Hypomera usually at least partly tomentose. Alimentary canal with more than three caeca on anterior margin of midgut. Each ovary with more than six egg tubes 9

11. Basal half of pronotum divided by a median longitudinal impression which usually ends in a transverse impression near or anterior to middle of pronotum. Hind wing with second anal three-branched; without an anal lobe. Alimentary canal with six caeca on the anterior margin of the midgut. Central nervous system with only the first four abdominal ganglia discrete ....NORTH and CENTRAL AMERICA ....**Neocylloepus** Brown (1970).

Pronotum with a deep and complete transverse impression, but never with a median longitudinal impression on disk. Hind wing with second anal two-branched; with a feebly developed anal lobe. Alimentary canal with three, two, or no caeca on the anterior margin of the midgut. Central nervous system with the first six abdominal ganglia discrete ....NORTH and SOUTH AMERICA, WEST INDIES ....**Neoelmis** Musgrave (1935).

The Species of *Neocylloepus*

All of the specimens I have examined are quite similar in general appearance. As best as I can determine, they represent five species in addition to that described by Hinton (1940). At present, female specimens of several species are separable only on the basis of geographic location (Fig. 22) or association with males, since two of the species are represented by unique male specimens.

It is my opinion that the redescription of *N. sculptipennis* (Sharp) given by Hinton (1940) was in fact based upon specimens of a different species, which I am naming *N. hintoni* sp. n. in honor of the describer, Dr. Howard E. Hinton, whose work on neotropical dryopoids has been truly monumental. The description and figures of *N. hintoni* sp. n. presented below are taken from his paper, as are the distribution data. I have not seen these specimens, nor have I examined Sharp's type during the preparation of this paper. Sharp's (1882) type specimen of *N. sculptipennis,* which is in the British Museum of Natural History, was collected by Champion in the Rio Naranjo, Guatemala. I presume that this is probably the Rio Naranjo which flows past Coatepeque, separating the departments of San Marcos and Quezaltenango in southwestern Guatemala, but since I am uncertain as to the location along the stream (or even whether this is the correct stream), I have not indicated the type specimen on the distribution map.

Since two of the six species listed are represented by unique male specimens, the key presented below is based largely upon features of the male genitalia.

Key to Species of *Neocylloepus* Based Primarily Upon Male Genitalia

1. Penis (dorsal aspect) shaped like a slender, long-necked French wine bottle, slightly dilated apically (Fig. 31); pronotal impressions inconspicuous or absent ....(Chiapas, Mexico) ....**N. petersoni** sp. n.

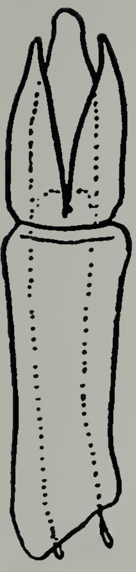
Penis not as above (broader or without apical enlargement); one or both pronotal impressions (median and transverse) usually conspicuous 2

2(1). Parameres (lateral aspect) rather plump, almost ovate; fulcrum of basal piece not prominent 3

Parameres more elongate; fulcrum of basal piece rather prominent 4

3(2). Penis (dorsal aspect) conspicuously broader than paramere (Fig. 34) ....(known only from Rio Axtla, S. L. P., Mexico) ....**N. arringtoni** sp. n.

Penis rather slender apically (Fig. 28) ....(highlands of central Mexico) ....**N. hintoni** sp. n.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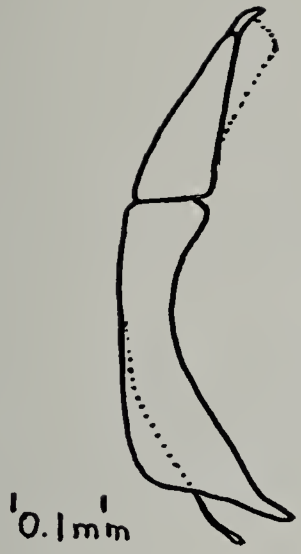

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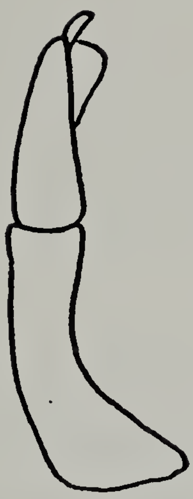
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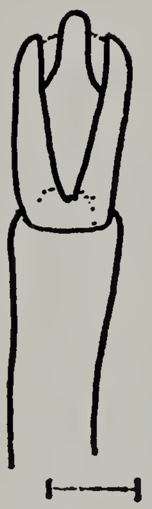
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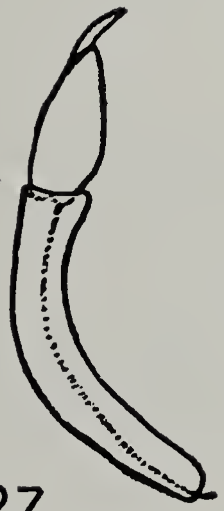
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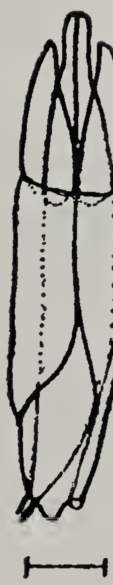
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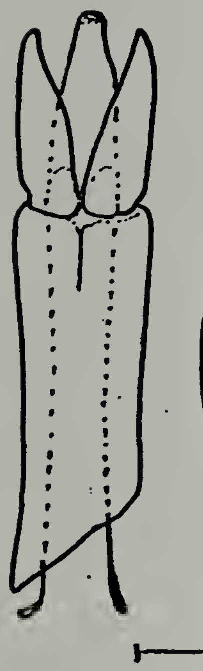
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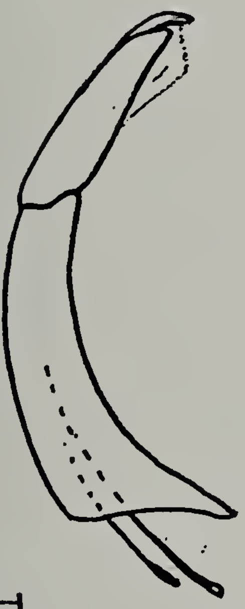
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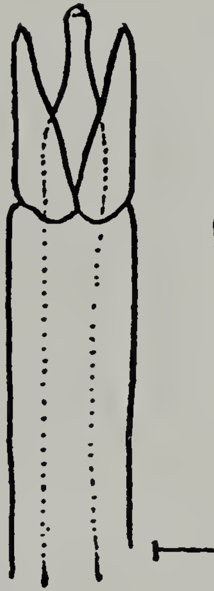
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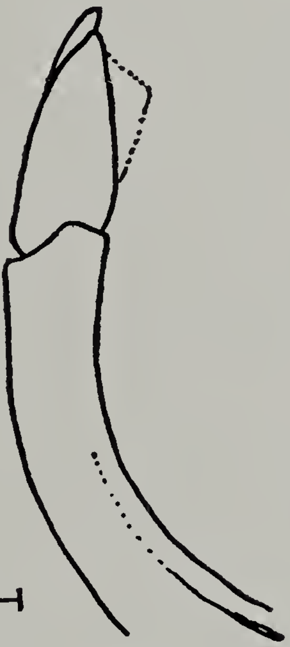
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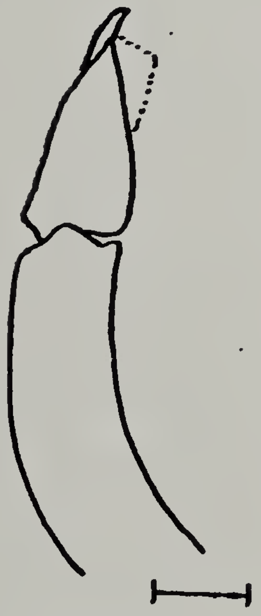
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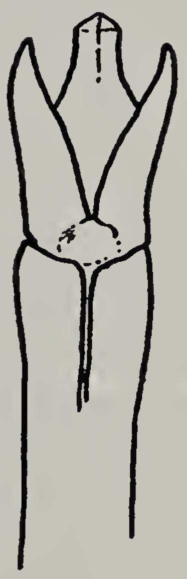
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Fig. 23. Male genitalia of *N. sculptipennis* (Sharp), dorsal aspect.

Fig. 24. Male genitalia of *N. sculptipennis* (Sharp), lateral aspect.

Fig. 25. Male genitalia of *N. sandersoni* sp. n., lateral aspect.

Fig. 26. Male genitalia of *N. sandersoni* sp. n., dorsal aspect.

Fig. 27. Male genitalia of *N. hintoni* sp. n., lateral aspect.

Fig. 28. Male genitalia of *N. hintoni* sp. n., dorsal aspect.

Fig. 29. Male genitalia of *N. boeseli* sp. n., dorsal aspect.

Fig. 30. Male genitalia of *N. boeseli* sp. n., lateral aspect.

Fig. 31. Male genitalia of *N. petersoni* sp. n., dorsal aspect.

Fig. 32. Male genitalia of *N. petersoni* sp. n., lateral aspect.

Fig. 33. Male genitalia of *N. arringtoni* sp. n., lateral aspect.

Fig. 34. Male genitalia of *N. arringtoni* sp. n., dorsal aspect.

4(2). Parameres (dorsal aspect) apically narrowed or pointed (Fig. 23) ----------
(from western Mexico to Nicaragua) ---------- **N. sculptipennis** (Sharp)
Parameres rather blunt apically ---------- 5
5(4). Penis (dorsal aspect) narrows abruptly toward apex; parameres hardly taper at all (Fig. 26)
----------(Costa Rica, Panama) ----------**N. sandersoni** sp. n.
Penis narrows gradually; parameres taper noticeably (Fig. 29) ----------
(Texas and northern Mexico) ---------- **N. boeseli** sp. n.

DESCRIPTION OF SPECIES

Neocylloepus hintoni n. sp. (Figs. 4, 11, 22, 27, 28)

Synonym: *Cylloepus sculptipennis* (Sharp) in Hinton (1940). Novitates Zool. 42 (2):347.

As stated above, in my opinion the specimens examined and described by Hinton represent not *N. sculptipennis* (Sharp), but a new species which I herewith name in his honor. All material here presented concerning this species is taken directly from his paper (Hinton, 1940), including the description and figures.

"*Male:* Length, 2.8 mm.; breadth, 1.12 mm. Subparallel, moderately convex. Clothed with fine, recumbent, brownish hairs which are about 0.05 mm. long and arise at intervals equal to more than once their lengths; labrum at sides with the hairs much longer and denser and paler. Cuticle shining and rufopiceous to nearly black; densely and minutely alutaceous on head, pronotum, hypomera, prosternal process, meso- and meta-sternum, all of first abdominal sternite, and sides of sternites two to five. *Head* without distinct impressions; surface densely and very minutely alutaceous so that under a magnification of X 150, it appears to be finely granulate; also set with low and irregularly shaped granules which are slightly finer than facets of eyes and are usually separated by less than to twice their diameters. Clypeus when viewed from in front with the anterior margin feebly and arcuately emarginate for its entire breadth, with the angle on each side broadly rounded; clypeal suture feeble and arcuate; surface similar to that of head but with only the base and sides alutaceous. Labrum with the anterior margin truncate and the angle on each side feebly rounded; surface with punctures which are not more than half as broad as granules of clypeus and are usually separated by less than to once their diameters. *Pronotum* with the broadest point at basal two-fifths and here broader than long (0.85 mm.: 0.80 mm.) and base broader than apex (0.80 mm.: 0 54 mm.). General shape and form and extent of the various impressions as figured (Fig. 11). Surface sculptured as head except for area near inner side of sublateral carinae on basal half, extreme base, and sides near lateral margins which are only feebly or not at all alutaceous. *Elytra* more than twice as long as prothorax (1.87 mm.: 0.80 mm.) and feebly broadening posteriorly to broadest point which is near apical third and which is distinctly broader than broadest point across humeri (1.12 mm.: 1.00 mm.). Lateral margins coarsely and densely crenate. Surface coarsely striate, discal striae finer and shallower as they approach apex but never altogether absent; discal strial punctures subquadrate to round, moderately deep, and at middle of disk as broad as intervals to slightly narrower and separated longitudinally by slightly more than to slightly less than their own diameters; toward sides the punctures become coarser and denser and toward apex finer and sparser. Discal intervals flat, the third at base being only very slightly convex. Elytra with only one sublateral carina. Surface of intervals with the granules slightly larger, more convex and more regularly round than those of pronotum and separated usually by one to four times their diameters; sutural interval on basal two-thirds and first four intervals on apical third with only an occasional granule; surface between granules with punctures similar to those of labrum but separated by one to five times their diameters. *Scutellum* flat, subovate, broader than sutural interval near base (0.12 mm.: 0.50 mm.) and as broad as long; surface sculptured as adjacent elytral intervals.

Prosternum with the anterior two-thirds (not including process) moderately strongly but not sharply lobed; surface granulate as elytral intervals except for surface of process which is sculptured as head. Hypomera very densely and regularly alutaceous with only an occasional granule and without tomentum. Mesosternum sculptured as prosternal process. Metasternum with the posterior third of disk only feebly depressed; with a broad (about 0.03 mm.) and deep median longitudinal impression which extends to apical fourth; surface of disk similarly but distinctly more coarsely sculptured than surface of prosternal process; sides of metasternum with the granules only showing through the tomentum and separated by one to three times their diameters, the surface here strongly resembling that of the legs. Abdomen with the carinae of the first abdominal sternite curving slightly inwards, complete from base to apex, and most prominent at apex; first sternite at middle strongly depressed, this depression very shallowly but nevertheless distinctly encroaching to middle of basal third of second sternite; middle of first sternite on basal two-thirds densely and minutely alutaceous and with deep round punctures which are about 0.02 mm. broad and are contiguous to separated by once their diameters; apical third of first sternite and all of middle up to apical four-fifths of fifth sternite not alutaceous and the punctures similar to those of first sternite, but becoming progressively finer as apex of abdomen is approached so that on basal fifth of fifth sternite they are only half as coarse. Sides of abdominal sternites granulate as sides of metasternum. *Genitalia* as figured (Figs. 27, 28).

"*Female:* Externally similar to male except as follows: (1) the carinae of the first abdominal sternite straight and not curved inwards, absent on apical sixth, and least instead of most prominent at apex; and (2) the depression of the middle of the first sternite does not extend on to second sternite.

"*Specimens* (Fig. 22): 8, MEXICO: Estado de Morelos, Cuernavaca, June, 1934; 2, MEXICO: Dist. de Temascaltepec, alt. 6,000-7,000 ft., June, 1934; 1 with same data as above but at Tejupilco, alt. about 4,000 ft., July, 1934. (Type series in British Museum of Natural History.)

"*Variations:* No variations worthy of mention have been noted."

In general, the above description is quite applicable to the remaining species except for size and the features mentioned below or figured as characteristic. For the sake of brevity (and because most of my spcimens are encrusted), I shall omit details of microsculpture. However, the following should be noted, not as specific characteristics, but as features probably applicable to all the species at hand: the crenation of elytral margins may present a distinctly serrate appearance before the posteriorly directed setae which crown the crenations become worn off or encrusted; the median depression of the first abdominal sternite varies in depth and in extent within the same sex and species, sometimes encroaching upon the second sternite in females and even upon the third in males; the longitudinal carinae bordering this depression vary considerably in curvature, in extent, and in magnitude in both sexes. In fact, I have been unable to determine the sex of some specimens without recourse to dissection. The median longitudinal furrow or impression and the transverse impression of the pronotum vary markedly, one or both being very distinct in some specimens but obsolete or barely perceptible in others; this difference appears to be one of individual variation within a species, unrelated so far as I can tell to sex, age, size, or locality.

Neocylloepus sculptipennis (Sharp). (Figs. 1, 12, 19, 20, 22, 23, 24)

Synonymy: *Elmis sculptipennis* Sharp. 1882. Biol. Centr.-Amer., Col. 1 (2): 135.

Cylloepus sculptipennis (Sharp) in part. Hinton, 1940. Novitates Zool. 42 (2):347.

Sharp's description is as follows:

Length 2.1 mm., width 1 mm.

Habitat: GUATEMALA, Rio Naranjo, elevation 450 ft. (Champion).

"Thorax elongate, very gently rounded at the sides, and only very slightly narrowed near the hind angles; parallel with the side there is a raised line extending the whole length, and the surface at the base close to the inner side of this line is more deeply impressed; at the base there is a central longitudinal channel extending forward for about half the length of the thorax where it meets a very obsolete transverse depression. Elytra with series of very coarse punctures, the inner of which become obsolete toward the apex, and with a fine, very definite elevated line, extending from the shoulder to the extremity. Metasternum very coarsely granulate; basal ventral segment very deeply impressed on the middle."

Sharp's description, based upon " . . . a single, rather immature individual . . . , " might now better serve as a generic characterization. His specimen was near the minimum size of those I assign to this species, which range from 2.1 to 2.7 mm in length and from 0.85 to 1.1 mm in width. Of 78 adults in my collection, most specimens are between 2.2 and 2.5 mm, individuals from only two of nineteen localities measuring less than 2.2 mm (Arriaga, Chiapas, Mexico, and Teculután, Zacapa, Guatemala) or exceeding 2.5 mm (Francisco Morazán, Honduras, and Madriz, Nicaragua). The descriptions given below are based upon specimens collected near the center of distribution (north of Arriaga, Chiapas, Mexico), about 170 miles northwest of the presumed type locality.

Male: Length, 2.1 mm, breadth, 0.9 mm. Subparallel, moderately convex. Clothed with fine, recumbent, brownish hairs about 0.04 mm long and arising at intervals slightly greater than their length; sides of labrum with hairs much longer, denser, and paler. Cuticle shining, rufo-piceous to piceous. Legs lighter, brownish; antennae still lighter, almost testaceous. *Head* without distinct impressions. Clypeus with anterior margin (viewed from in front) feebly and arcuately emarginate for its entire breadth, with angles broadly rounded; surface similar to that of head. Labrum with the anterior margin rounded; surface glabrous, translucent brown. *Pronotum* 0.70 mm long and 0.70 mm wide, the region of greatest breadth being at the basal third (in other specimens at the basal two-fifths); basal width 0.65 mm, apical width 0.50 mm. Median sulcus distinct, but transverse impression obsolete. *Elytra* 1.50 mm long, 0.825 mm wide at humerus, and 0.90 mm wide at broadest point, which is near middle. Lateral margins crenate to serrate. *Scutellum* flat, subcircular, 0.10 mm in diameter, slightly broader than sutural interval near base. *Prosternum* 0.55 mm long and 0.50 mm wide; prosternal process 0.237 mm long, 0.125 mm wide at its waist (narrowest point), and flaring to a maximal apical width of only 0.137 mm. Margins of prosternal process raised, these ridges continuing about halfway around the anterior edge of the procoxae, then forward as carinae which extend about halfway to the anterior margin of the prosternum. Mesosternum and metasternum sculptured as prosternum. Disc of metasternum feebly depressed; median sulcus abruptly expanding into a depression near apex. *Abdomen* with deep medial depression of first sternite extending shallowly across second sternite. Carinae bordering depression of first sternite most prominent and slightly convergent apically. *Genitalia* as figured (Figs 23, 24).

Female: Generally similar to male, but usually somewhat larger. Carinae of prosternum and first abdominal sternite feebly developed, the latter being obsolete posteriorly, and not convergent. Depression of first abdominal sternite shallow, barely encroaching upon second sternite. Measurements for one specimen from the same locality are: length 2.25 mm, breadth 0.925 mm; pronotum 0.725 mm long and 0.750 mm wide, with basal width of 0.725 mm and apical width of 0.55 mm; elytra 1.61 mm long and 0.8 mm wide at humerus; prosternum 0.625 mm long and 0.6 mm wide, the prosternal process being 0.250 mm long, 0.150 mm at the waist, and 0.175 mm at the apex. Genitalia as figured (Figs 19, 20).

Type: Specimen in British Museum (Natural History). GUATEMALA: Rio Naranjo, collected by G. C. Champion.

Specimens (Fig. 22): MEXICO: Estado de Chiapas—north of Arriaga, 2 adults in November, 1964, 17 adults and one larva in October, 1966; between Arriaga and Tonalá, 3 adults in November, 1964; near Ortiz Rubio, 1 adult in November, 1964; south of Las Cruces, 6 adults in October, 1966; Estado de Colima—southeast of Colima, 4 adults in November, 1964; Estado de Guerrero—1 larva near Xaltianguis and 1 near Playon in March, 1969; about 5 km west of El Ocotito, 2 adults and 28 larvae in April, 1969; about 12 km west of El Ocotito, 3 adults and 7 larvae in April, 1969; south of Tierra Colorada, 1 adult and 7 larvae in April, 1969; near El Cuarenta, 2 larvae in April, 1969; Estado de Jalisco—Tamazula, 1 adult in November, 1964; Estado de Nayarit—Ixtlan del Rio, 3 adults in November, 1964. GUATEMALA: Departamenta de Guatemala—northeast of Guatemala City, 5 adults in October, 1966; Departamenta El Progreso—near San Cristobal Acastoquastlan, 1 larva in October, 1966; Departamenta Santa Rosa—Taxisco, 1 adult in November, 1966; Departamenta Suchitepequez—Puente Poca, about 30 miles west of Escuintla, 1 adult in October, 1966; Departamenta Zacapa—Rio Huyus near Teculután, 7 adults in October, 1966. HONDURAS: Departamenta Choluteca—Rio Coco east of El Banquito, 1 adult in November, 1966; Departamenta Francisco Morazán—Rio del Hombre north of Támara, 6 adults in November, 1966. NICARAGUA: Departamenta Estelí—east of Estelí, 1 adult in November, 1966; Departamenta Madriz—Rio Taparcale west of Somoto, 13 adults in October, 1966. These localities range from about 500 to about 5,000 feet in elevation.

Variations: Although the median pronotal furrow is usually distinct and deep, the transverse impression varies from conspicuous to obsolete or imperceptible in both sexes. The widest portion of the pronotum ranges from about the basal one-third to two-fifths, that of the elytra from about the middle to the apical one-third. The carinae of the first abdominal sternite vary enough to render some individuals not even identifiable as to sex on this basis. Flaring of the prosternal process varies considerably, as does the ratio between prosternal length and width. The legs of some specimens exhibit quite a bit of black, especially on the dorsal surfaces. In some specimens, the scutellum is pentagonal with rounded angles (Fig. 12).

Neocylloepus boeseli sp. n. (Figs. 2, 3, 5-7, 9, 10, 13-18, 22, 29, 30, 37-49)

This species is named in honor of Dr. Marion W. Boesel, Professor Emeritus of Zoology at Miami University, Oxford, Ohio, under whom I first studied entomology.

Male: Length, 2.95 mm; breadth, 1.1 mm. Clothed with fine, recumbent, pale hairs which are about 0.03 mm long and arise at intervals equal to or slightly greater than their length; hairs of antennae arising from apical ends of segments, those of terminal segment forming an apical brush; hairs of labrum as shown in Fig. 2, short medially, long laterally, those on the exterior surface being acute except for the very short, blunt, antero-median group, while those arising beneath the margin are blunt, often curved, and directed medially. Cuticle shining and reddish brown; legs somewhat lighter; antennae rufo-testaceous. *Head* as described for *N. hintoni*. *Pronotum* 0.93 mm long, 0.925 mm wide at broadest point, which is at basal one-third; basal width 0.875 mm and apical width 0.625 mm. *Elytra* 2.1 mm long, 1.0 mm wide across humeri, and broadest near apical third (1.1 mm); margins crenate to serrate. *Scutellum* flat, subovate, 0.150 mm long and 0.115 mm wide, as compared with a sutural interval of about 0.08 mm near base. *Prosternum* (Fig. 7) 0.75 mm long and 0.60 mm wide; prosternal process 0.280 mm long, 0.135 mm wide at waist, and flaring to 0.165 mm apically. Margins of prosternal process raised as in *N. sculptipennis,* the ridges continuing about halfway around the anterior edge of the procoxae, then extending anteriorly as carinae a little more than halfway toward the anterior margin of prosternum. *Metasternum* with disc feebly depressed, but rising from this depression, the margins of the shallow median sulcus are raised in the forward half, gradually sinking to the level of the surrounding depression posteriorly; the median sulcus is relatively inconspicuous. *Abdomen* with concavity of first sternite continuous with depression of metasternum and extending shallowly across second sternite, carinae of first sternite most prominent apically and very slightly convergent. *Genitalia* as figured (Figs. 29, 30), the parameres in lateral aspect being quite slender and elongate.

Female: Similar to male, but generally larger. Prosternum without real carinae, the margins of the prosternal process being scarcely raised. Carinae of first abdominal sternite feeble, obsolete apically, and not perceptibly convergent, sometimes even being slightly divergent. Depression of first abdominal sternite encroaching upon second sternite barely if at all. Measurements for specimen from type locality: length, 3.25 mm; breadth, 1.2 mm; pronotum 1.0 mm long and 1.0 mm wide with basal width of 0.925 mm and apical width of 0.71 mm; elytra 2.35 mm long and 1.1 mm across humeri; prosternum 0.70 mm long and 0.68 mm wide, the prosternal process being 0.30 mm long, 0.125 mm at the waist, and flaring to an apical width of 0.175 mm. Genitalia as figured (Figs. 14, 16).

Type: Male in Stovall Museum of Science and History, Norman, Oklahoma. U. S. A.: Texas—Devil's River about 20 miles south of Juno, Val Verde County, August, 1967. Elevation about 1,200 feet.

Paratypes: 11 adults collected with the type and 13 adults collected in the same locality in May, 1969. Paratypes will be deposited in the U. S. National Museum, Washington, and the collection of the Illinois Natural History Survey, Urbana.

Other specimens (Fig. 22): 5 larvae collected with the type and 28 larvae collected in the same locality in May, 1969. MEXICO: Estado de Nuevo Leon —Rio Ramos about 2 miles southeast of Allende, 2 adults in October, 1964. Elevation about 1,650 feet.

Variations: The transverse impression of the pronotum varies from distinct to obsolete; the median furrow also varies considerably but is perceptible in all specimens. The location of the widest point on both pronotum and elytra varies noticeably, but the general slender aspect of the species is maintained. In addition to the sexual differences mentioned above, the carinae of the prosternum and first abdominal sternite vary markedly in prominence as does the flaring of the prosternal process. In size, this species ranges from 2.55 to 3.25 mm long and 1.0 to 1.2 mm wide, the smallest being one of those from Mexico. Of the last 13 specimens collected, 6 were females, ranging from 2.85 to 3.25 mm in length. In contrast, 5 of the 7 males were 2.8 mm or less, the smallest being 2.75 mm long.

Comparative notes: At the risk of boosting the already adequate ego of Texans, I note the fact that members of this species, especially those from Texas, are larger than those of any other species. Judging from Hinton's (1940) figure and description of *N. hintoni* sp. n. (as *Cylloepus sculptipennis),* I presume that members of the latter species which overlap the size range of *N. boeseli* sp. n. exhibit the relatively compact aspect depicted in Fig. 11, whereas specimens of *N. boeseli* sp. n. are noticeably slenderer (with the well-known lanky Texas figure). All the other species here described have contours essentially like that of *N. hintoni* sp. n. Since the translucent brown color of the cuticle appears in specimens taken both in May and in August, regardless of the amount of encrustation, this may be a useful diagnostic feature, although I suspect that it might be greatly influenced by the chemical composition of the water. The parameres of the male genitalia seen in lateral aspect probably provide the safest diagnostic character.

Neocylloepus sandersoni sp. n. (Figs. 8, 21, 22, 25, 26, 35, 36)

This species is named in honor of Dr. Milton W. Sanderson, Taxonomist for the Illinois State Natural History Survey at Urbana, who first directed my attenion to dryopoid beetles and who has done more than any other to elucidate the taxonomy of the Nearctic elmids.

Male: Length, 2.08 mm; breadth, 0.925 mm. Clothed with fine, recumbent, pale hairs which are about 0.04 mm long and arise at intervals approximating this distance; hairs of antennae arising from distal whorls, the terminal segment bearing two subapical whorls (Fig. 8); sides of labrum with hairs much longer and denser. Cuticle shining, reddish brown to rufo-piceous. Legs lighter; antennae yet lighter, rufo-testaceous. *Head* without distinct impressions. Clypeus with anterior margin feebly and arcuately emarginate for its entire breadth, with angles broadly rounded; surface similar to that of head. Labrum truncate. *Pronotum* 0.70 mm long and 0.725 mm wide, the broadest point being at about basal two-fifths; basal width 0.69 mm, apical width 0.50 mm. Median sulcus distinct; transverse impression deep and conspicuous. *Elytra* 1.05 mm long, 0.825 mm across humeri, and 0.925 mm wide at broadest point, which is near middle. Lateral margins crenate to serrate. *Scutellum* flat, pentagonal with rounded angles, 0.10 mm long and 0.085 mm wide; broader than sutural interval near base, which is about 0.065 mm. *Prosternum* 0.59 mm long and 0.063 wide; prosternal process 0.25 mm long, 0.142 mm at the waist, flaring to 0.174 mm apically. Margins of prosternal process raised, the ridges continuing about halfway around anterior edges of procoxae, then extending anteriorly as carinae a little more than halfway toward the anterior margin of prosternum. *Metasternum* with disc very feebly depressed; margins of median sulcus slightly raised; median sulcus shallow and inconspicuous, gradually expanding posteriorly. *Abdomen* with concavity of first sternite continuous with depression of metasternum and extending shallowly across second sternite; carinae of first sternite relatively feeble, slightly more prominent and noticeably convergent apically. *Genitalia* as figured (Figs. 25, 26), with penis narrowed abruptly beyond the middle and parameres as seen in dorsal aspect slender and elongate.

Female: Similar to male, but generally larger. Carinae of first abdominal sternite feeble, not extending to apical margin, slightly divergent apically. Depression of first abdominal sternite shallow, not reaching apical margin. Measurements for specimen from type locality: length, 2.20 mm; breadth, 0.97 mm; pronotum 0.737 mm long and 0.775 mm wide with basal width of 0.725 mm and apical width of 0.550 mm; elytra 1.59 mm long and 0.862 mm across humeri; prosternum 0.585 mm long and 0.535 mm wide, the prosternal process being 0.263 mm long, 0.150 mm at the waist, and flaring to 0.175 mm apically. Genitalia as figured (Fig. 21).

Variations: The specimens at hand range from 1.8 to 2.5 mm long and from 0.85 to 1.0 mm wide. As in the other species described, there is considerable variation in the depth of the pronotal impressions, the prominence, curvature, and extent of the carinae of the first abdominal sternite, and the shape of the prosternal process.

Comparative notes: Although the minimal size indicated above might suggest that members of this species are unusually small, the average size is probably close to that of *N. sculptipennis.* The smallest specimen from the type locality (from which the majority of specimens were taken) is 2.25 mm long. The best diagnostic character is the shape of the parameres of the male genitalia as seen in dorsal aspect: they are quite narrow at the base, tapering very little throughout their length. The penis, too, is rather characteristic, narrowing so abruptly as to give a shouldered appearance.

Type: Male in Stovall Museum of Science and History, Norman, Oklahoma. COSTA RICA: Provincia de Puntarenas—small river 4 miles west of Canoas near the Panamanian border, November, 1966. Elevation about 800 feet.

Paratypes (Fig. 22): Twenty adults collected with the type. Six larvae were taken in the same collection. Paratypes will be deposited in the U. S. National Museum, Washington, and the Illinois Natural History Survey, Urbana, Illinois.

Other specimens (Fig. 22): COSTA RICA: Provincia Guanacaste—Rio Piedras west of Bagaces, 1 adult in November, 1966. PANAMA: Provincia Chiriquí—south of Guabalá, 1 adult in November, 1966; Provincia Panama—small stream west of La Chorrera, 6 adults in November, 1966; Rio Pacora north of Pacora, 5 adults and 4 larvae in June, 1968. All elevations less than 1,000 feet.

Neocylloepus petersoni sp. n. (Figs. 22, 31, 32)

This species is named in honor of Dr. Alvah Peterson, Professor Emeritus of Zoology and Entomology, Ohio State University, Columbus.

Male: Length, 2.5 mm; breadth, 1.0 mm. Clothed with fine, recumbent, pale hairs which are about 0.035-0.04 mm long and arise at intervals slightly less than to slightly greater than their length; hairs of antennae most prominent on last few segments, where they are relatively dense; sides of labrum with hairs much longer and denser. Cuticle shining, reddish brown to rufo-piceous. Legs and antennae lighter, rufo-testaceous. *Head* without distinct impressions. Clypeus as in other species. Labrum feebly rounded. *Pronotum* 0.78 mm long and 0.85 mm wide, the broadest point being at about basal two-fifths; basal width 0.80 mm, apical width 0.53 mm. Median furrow shallow, hardly perceptible; transverse impression obsolete, almost imperceptible. *Elytra* 1.80 mm long, 0.925 mm across humeri, and 1.0 mm at widest point, which is between middle and apical third. Lateral margins serrate. *Scutellum* flat, pentagonal with rounded angles, 0.125 mm in both length and width; slightly broader than sutural interval near base. *Prosternum* 0.62 mm long and 0.60 mm wide; prosternal process 0.275 mm long, 0.128 mm at waist, flaring to 0.177 mm apically. Margins of prosternal process raised slightly, the ridges continuing about halfway around anterior edges of procoxae, then extending forward as feeble carinae about halfway toward the anterior margin of prosternum. *Metasternum* with disc feebly depressed; margins of median sulcus moderately raised; median sulcus expanding abruptly near apex. *Abdomen* with concavity of first sternite extending across second sternite; carinae of first sternite apically prominent and convergent. *Genitalia* as figured (Figs. 31, 32), with parameres rather like those of *N. arringtoni* sp. n., but with penis slender and apically elongate, resembling a champagne bottle.

Female: Unknown.

Comparative notes: Since this species is represented by a unique male specimen and since nothing is known of the variations within the species, I can only speculate as to which features mentioned above are characteristic. Judging from the situation in the other species described above, I surmise that the lack of distinct pronotal sulcus and transverse impression may represent mere individual variation rather than valid specific characteristics. As with the other species, the genitalia probably provide the best diagnostic features—the penis in dorsal aspect being conspicuously slenderer toward the apex than that of any other species except *N. hintoni* sp. n., the penis of which is noticeably longer in lateral aspect.

Type: Male in Stovall Museum of Science and History, Norman, Oklahoma. (Fig. 22) MEXICO: Estado de Chiapas—Rio Teapa or a tributary thereof north of Tapilula where the road (Mex. 195) toward Ixhuatan crosses a cataract; December, 1966. Elevation estimated between 3,000 and 4,000 feet.

Neocylloepus arringtoni sp. n. (Figs. 22, 33, 34)

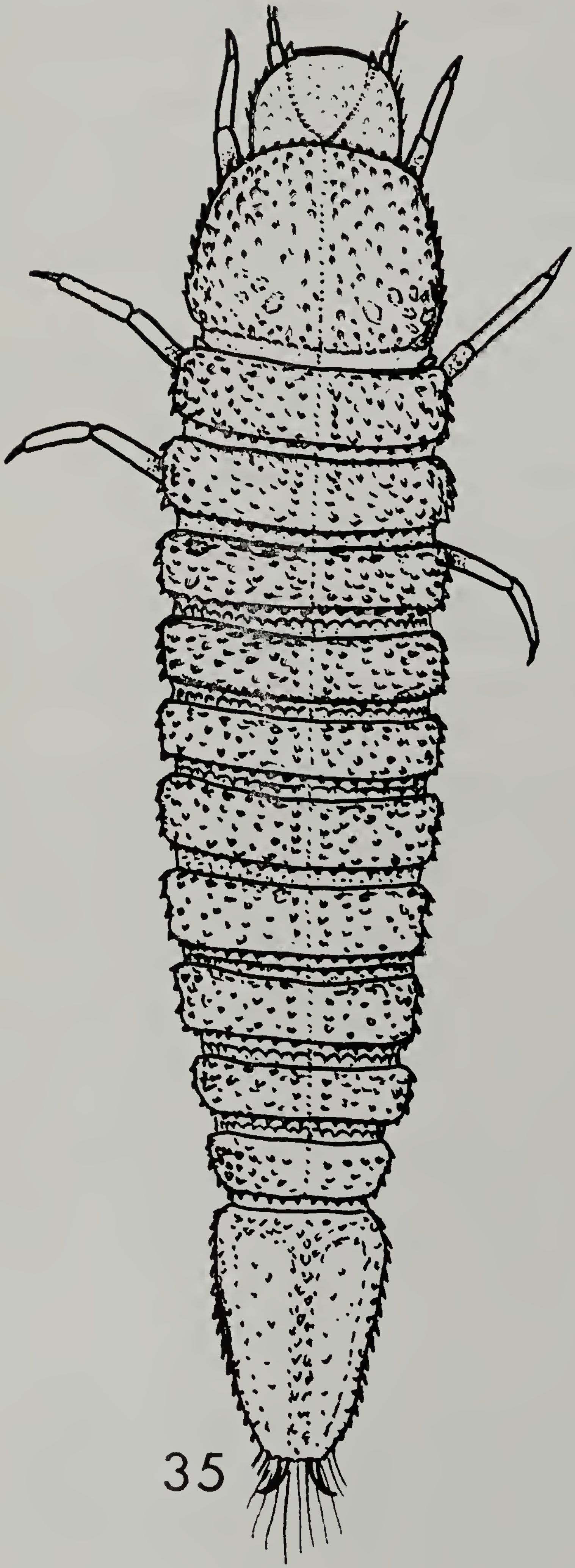
This species is named in honor of Dr. Richard Arrington, Professor of Biology and Dean at Miles College, Birmingham, Alabama, who was the first man to complete a doctoral dissertation based upon the Stovall Museum dryopoid collection.

Male: Length, 2.30 mm; breadth, 0.95 mm. (Vestiture probably as in previous species, but specimen too encrusted to observe details.) Cuticle shining, reddish brown to rufo-piceous; legs and antennae lighter, the later rufo-testaceous. *Head* as in previous species, with similarly emarginate clypeus; labrum feebly rounded. *Pronotum* 0.68 mm long and 0.75 mm wide, the broadest point at about basal one-third; basal width 0.725 mm, apical width 0.55 mm. Median furrow moderately well defined; transverse impression moderately distinct. *Elytra* 1.575 mm long, 0.85 mm across humeri, and 0.95 mm across broadest point, which is near middle. Lateral margins serrate. *Scutellum* flat, ovate, 0.10 mm long and 0.09 mm wide. *Prosternum* 0.604 mm long and 0.575 mm wide; prosternal process 0.25 mm long, 0.121 mm at waist, flaring to 0.163 mm apically. Margins of prosternal process raised, the ridges continuing about halfway around anterior edges of procoxae, then extending forward as carinae about halfway toward the anterior margin of prosternum. *Abdomen* with concavity of first sternite extending across second sternite; carinae of first sternite apically prominent, attaining margin, but only slightly convergent apically. *Genitalia* as figured (Figs. 33, 34), the parameres rather similar to those of *N. petersoni* sp. n. and *N. hintoni* sp. n., but with a broad penis which, in dorsal aspect, resembles a milk bottle.

Female: Unknown.

Comparative notes: This species is also represented by a unique specimen, so nothing can be stated as to variation within the species. Again, the genitalia provide the safest means of identification. The parameres are quite like those of *N. hintoni* sp. n. and *N. petersoni* sp. n., but the penis in dorsal aspect is much broader than that of either of these species.

Type: Male in Stovall Museum of Science and History, Norman, Oklahoma. (Fig. 22) MEXICO: Estado de San Luis Potosi—Rio Axtla about 8 miles north of Matlapa (47 miles south of Ciudad Valles). Elevation about 400 feet.



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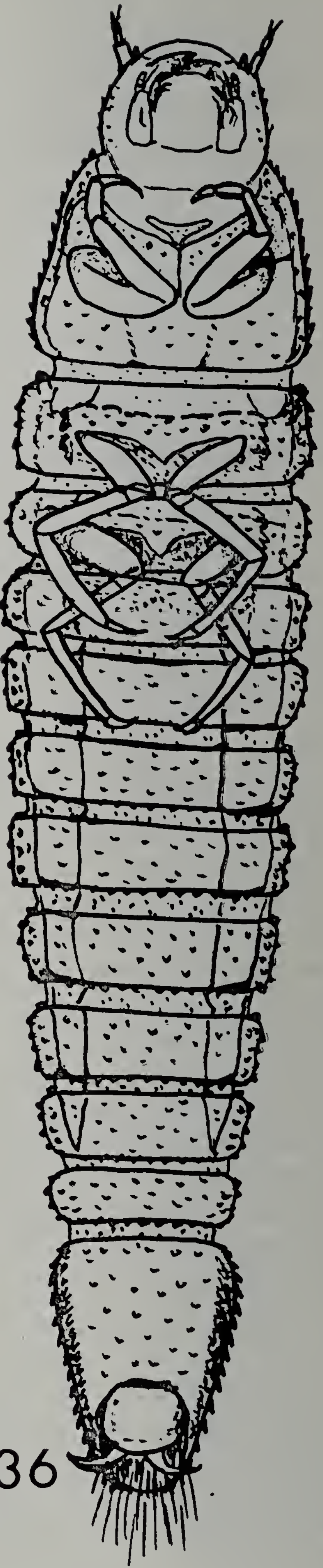

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Fig. 35. *N. sandersoni* sp. n., mature larva, dorsal aspect. Drawn from specimen collected near Canoas, Costa Rica.

Fig. 36. *N. sandersoni* sp. n., mature larva, ventral aspect.

LARVAE

As stated in the Introduction, the larvae were identified by elimination and association. They are different from those of any other known genera. They are appropriate in size. They were collected in the presence of adult specimens of *Neocylloepus* eight times in seven different localities ranging all the way from Texas to central Panama. In none of these collections were there adults of other genera which could have been associated with these larvae. In only four localities were these larvae taken in the absence of *Neocylloepus* adults, and in each of these cases (3 in Mexico, 1 in Guatemala), adult specimens of *Neocylloepus* were collected within 25 miles—usually in the same drainage system. The larva is very much like that of *Elsianus* and that of *Stenelmis*—in other words, it is a typical elmid larva. In view of such overwhelming circumstantial evidence, I consider it entirely reasonable to assume that the larvae described below are those of *Neocylloepus,* even though they have not been reared to maturity under controlled conditions.

Generic Characters of Larvae of *Neocylloepus*

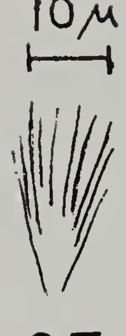
Body subparallel, hemicylindrical to cylindrical except for ninth abdominal segment, which is pentagonal in cross-section (Fig. 50). Cuticle rather opaque, rather densely studded with tubercles.

Head (Figs. 35, 36, 39) exposed, not concealed beneath pronotum; anterior margin with a prominent tooth on each side between clypeus and antenna, with one ocellus on each side. Antennae 3-segmented and feebly retractile; last segment setiform, subequal in size to and side by side with seta arising from apex of second segment. Mandibles (Fig. 41) of both sides similar, each with 3 subacute apical teeth; prostheca long, slender, and densely hirsute. Maxilla (Fig. 42) with palp 4-segmented, stipes showing no differentiation into palpifer; galea and lacinia separate, galea with apical tuft of spines, lacinia with mesial and apical spines. Labium (Fig. 43) with rather elongate mentum, transverse submentum; labial palp 2-segmented; prementum with appreciable palpiger.

Prothorax (Figs. 36, 40) with pleura divided into two parts, the anterior pleura meeting mid-ventrally so that anterior sternum is completely suppressed; posterior sternum well developed; procoxal cavities contiguous, separated by only a minute sclerite. Just anterior to the prothorax in the midventral line is a small, transverse adventitious sclerite. Meso- and metapleura divided into two parts.

Abdomen with pleura of first 7 segments bounded by tergo- and sterno-pleural sutures, segments 8 and 9 forming complete sclerotized rings. Operculum (Figs. 47, 49) of ninth segment with 2 heavily sclerotized claws attached to its dorsal membrane, visible only when the operculum is opened for gill extrusion. Ninth segment (Figs. 35, 36, 47, 48, 50) with 5 longitudinal carinae: median dorsal; paired dorso- and ventro-laterals. *Spiracles* present on mesothorax and first 8 abdominal segments and opening on small tubercles. Tracheae without air sacs. Three tufts of retractile, anal, tracheal gills present: 1 dorsal and paired laterals. *Alimentary canal* with well-developed stomodeal armature (Fig. 46). Other features of the internal anatomy are being investigated by Mr. Edwin A. Green.

The larvae of this genus are similar in many respects to those of *Elsianus, Macrelmis, Microcylloepus, Neoelmis, Ordobrevia,* and *Stenelmis.* From all they differ in having median and dorso-lateral carinae on the ninth abdominal segment. Unlike *Ordobrevia* and *Stenelmis,* they have prothoracic pleura distinctly



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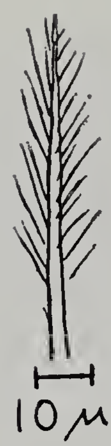

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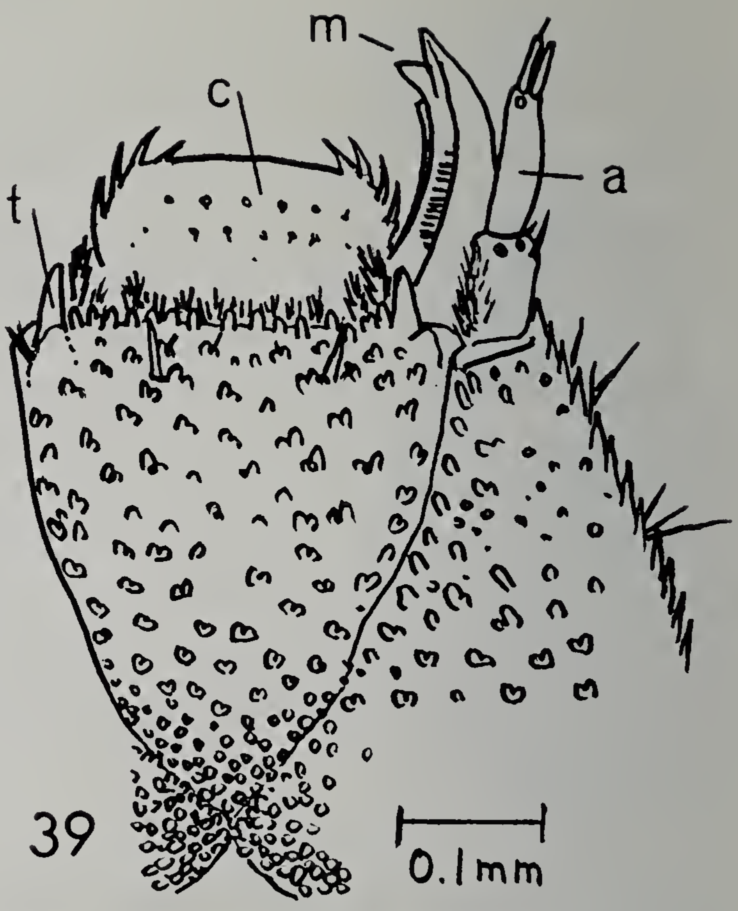

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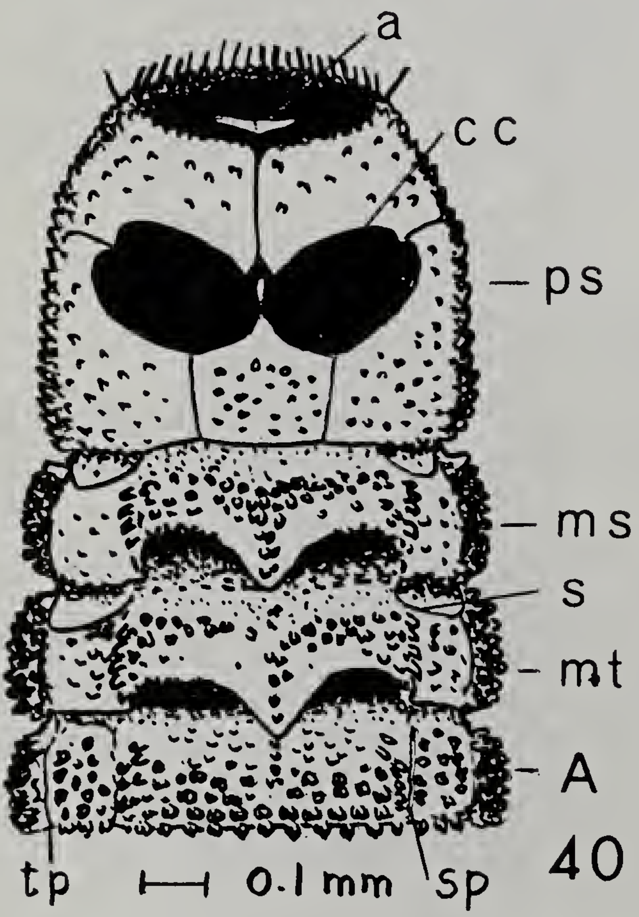

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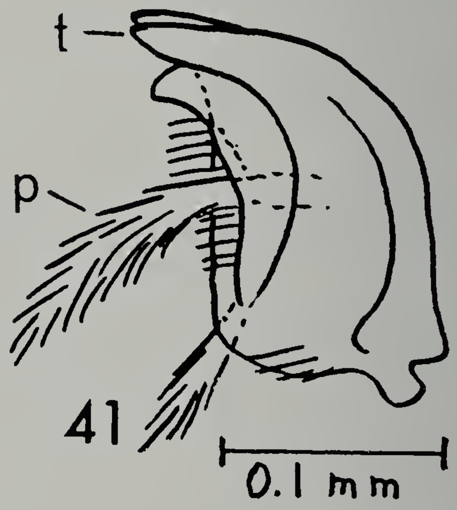

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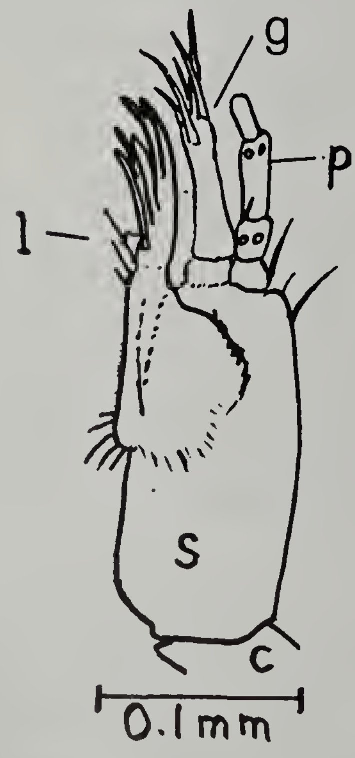

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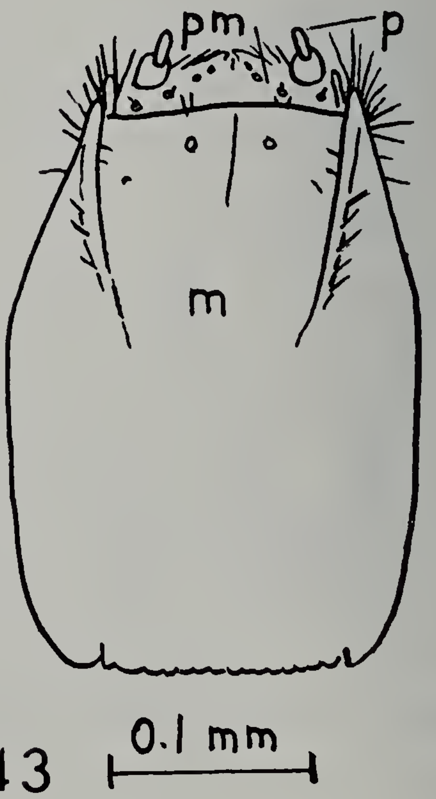

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Fig. 37. *N. boeseli* sp. n., ramose seta from middle of anterior margin of frons.

Fig. 38. *N. boeseli* sp. n., ramose seta from anterior margin of frons near large marginal tooth.

Fig. 39. *N. boeseli* sp. n., enlarged view of portion of larval head in dorsal aspect, showing details of ornamentation. Key to abbreviations: *a*—antenna, *c*—clypeus, *m*—mandibular teeth, *t*—"tooth" on anterior margin of frons.

Fig. 40. *N. boeseli* sp. n., larval thorax and first abdominal segment, ventral aspect. Key to abbreviations: *a*—accessory sclerite, *c c*—coxal cavity, *ps*—prosternum, *ms*—mesosternum, *mt*—metasternum, *s*—suture dividing pleuron into anterior and posterior pleurites, *sp*—sternopleural suture, *tp*—tergopleural suture, *A*—first abdominal sternite.

Fig. 41. *N. boeseli* sp. n., left mandible of larva, ventral aspect. Key to abbreviations: *p*—prostheca, *t*—apical mandibular teeth.

Fig. 42. *N. boeseli* sp. n., left maxilla of larva, ventral aspect. Key to abbreviations: *g*—galea, *l*—lacinia, *p*—palp, *s*—stipes, *c*—cardo.

Fig. 43. *N. boeseli* sp. n., labium of larva, ventral aspect. Key to abbreviations: *p*—palp, *pm*—prementum, *m*—mentum.

divided into two parts. Their prothoracic intercoxal sclerites most resemble those of *Microcylloepus,* but they possess prominent teeth on the anterior margins of the head, thus differing from both *Microcylloepus* and *Neoelmis.*

The key provided by Bertrand (1955) is the most comprehensive one available for the dryopoid larvae of the New World, including the families Elmidae, Dryopidae, and Limnichidae. His addendum (1965) added the larva of *Hexacylloepus* Hinton, with notes on the larvae of several other genera. To add *Neocylloepus* gen. n. to his key (Bertrand, 1955, p. 135), insert the following couplet between 27 and 28:

27a Neuvième segment abdominal pentagonal à coupe en travers, chaque angle caréné .... **Neocylloepus BROWN.**

27b (28) Neuvième segment abdominal hémicylindrique, sans carène sagittale, ou dorsolatérale.

Hinton's key is the only one in English covering the larvae of tropical American elmids. To add *Neocylloepus* gen. n. to his key (Hinton, 1940, p. 230), in the first part of couplet 17 delete "NORTH and SOUTH AMERICA . . . *Elsianus* Sharp (1882)" and insert in its place the number 19. On the next page, after couplet 18, insert the following couplet:

19 Ninth abdominal segment pentagonal in cross-section, with a median dorsal carina and on each side a dorso-lateral carina ----------
NORTH and CENTRAL AMERICA ---------- **Neocylloepus** Brown (1970).
Ninth abdominal segment somewhat hemicircular in cross-section, without dorsal or dorsolateral carinae ----------
NORTH and SOUTH AMERICA ---------- **Elsianus** Sharp (1882).

The most useful and widely used keys to elmid larvae within the United States are those of Leech and Sanderson (1959), in which *Neocylloepus* gen. n. would key out to *Elsianus,* and Leech and Chandler (1963), in which it would key out to *Microcylloepus* (first instar). To add *Neocylloepus* gen. n. to the key of Leech and Sanderson (1959, p. 1017), at the end of 66b delete "*Elsianus* Sharp" and insert "66c"; then insert a couplet as follows:

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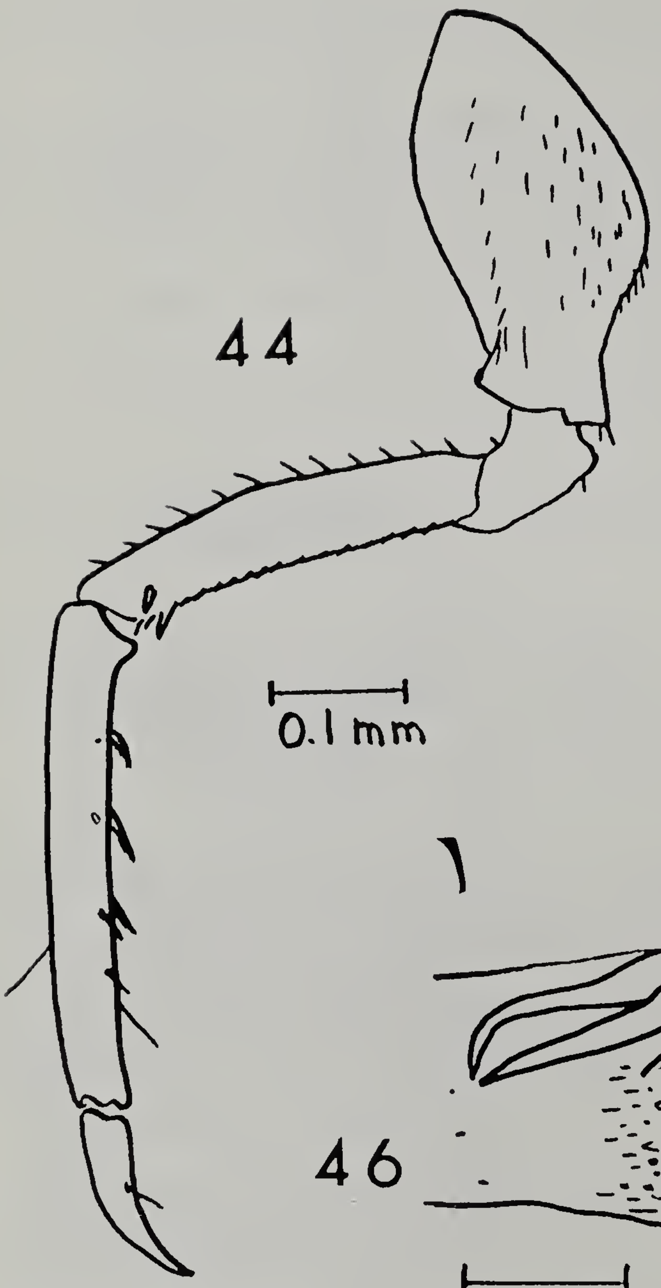

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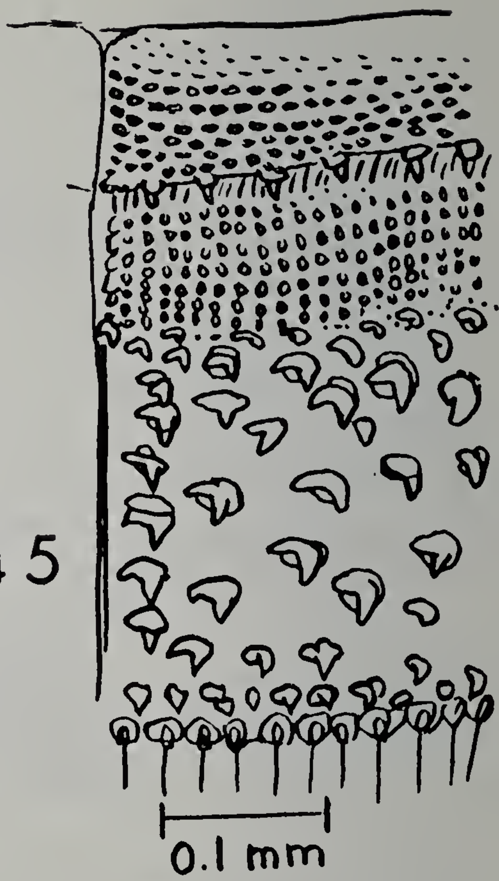

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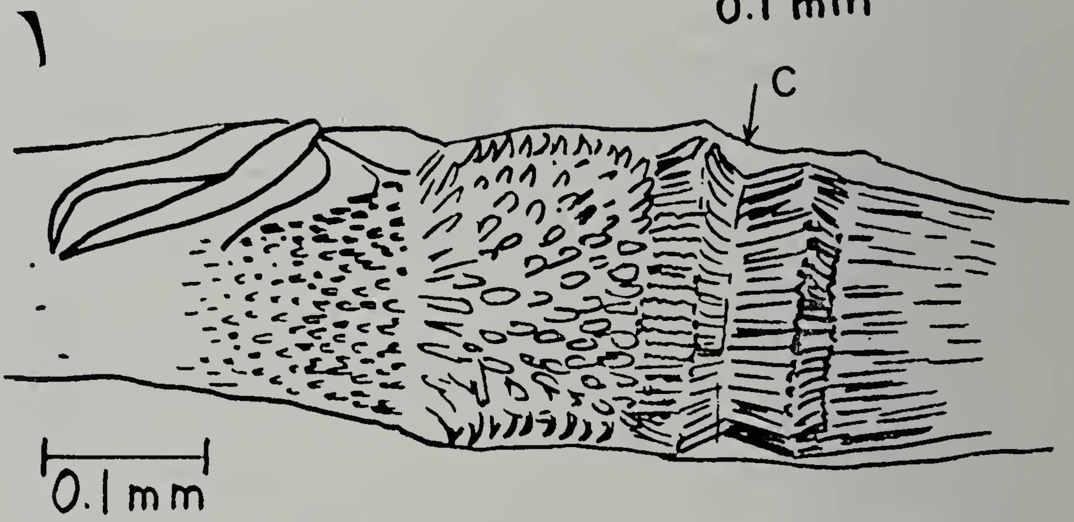


Fig. 44. *N. boeseli* sp. n., right mesothoracic leg of larva, ventral aspect.

Fig. 45. *N. boeseli* sp. n., a portion of the fourth abdominal tergite of larva, dorsal aspect, to show arrangement of tubercles. Mid-dorsal ecdysial line at left, anterior margin at top, posterior margin at bottom.

Fig. 46. *N. boeseli* sp. n., stomodeal armature of larva viewed from the right side. The cervical region is indicated by the letter *c;* the portion to the right of *c* is located in the head, that to the left of *c* being in the prothorax.

66c (66) Ninth abdominal segment with a median dorsal carina and on each side a longitudinal dorsolateral carina; integument rough and granular; with a small, median, transverse accessory sclerite just anterior to prosternum .... **Neocylloepus** Brown

66d Ninth abdominal segment without dorsal or dorso-lateral carinae; integument rather smooth; without accessory sclerite ahead of prosternum .... **Elsianus** Sharp

To add *Neocylloepus* gen. n. to the key of Leech and Chandler (1963, p. 360), modify the first half of couplet 21 by deleting "(first instars of) . . . *Microcylloepus* Hinton 1935" and replacing this with the numeral 24; then insert at the end of the key a couplet as follows:

24 Anterior margin of head on each side with a conspicuous tooth between clypeus and antenna .... **Neocylloepus** Brown 1970
Anterior margin of head without such teeth .... first instar of **Microcylloepus** Hinton 1935

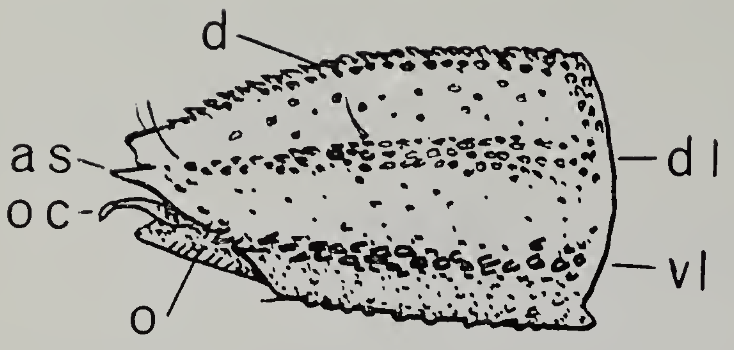
Description of Mature Larva of *N. boeseli* sp. n.
(Figs. 37-49)

Length, 5.0-6.0 mm; breadth across prothorax about 0.75 mm, increasing to about 0.80 mm across mesothorax, about 0.85 mm across metathorax, and slightly more (sometimes as much as 0.90 mm) across the first 4 abdominal somites. Elongate, subparallel; hemicylindrical to cylindrical (eighth abdominal segment), to pentagonal in cross-section (ninth abdominal segment). Cuticle relatively opaque and dull, fuscous to fusco-cinereous; legs, mouthparts, and antennae paler brown to testaceous. Abdomen on each side with a white line just above the spiracles beginning on the second and extending halfway across the eighth segment.

Head about 0.50 mm wide across eyes and about as long as wide; coronal suture about 0.07 mm long, diminishing from about 0.10 mm at base to about 0.01 anteriorly; frontal suture on each side extending in a curved line to anterior margin of head at inner base of antenna; anterior margin between clypeus and base of antenna with a tooth-like projection which extends beyond the anterior margin of the clypeus, a little more than half the length of the first antennal segment; surface sparsely pubescent, the rather stiff, decumbent hairs being about 0.02-0.03 mm long, projecting anteriorly, and most conspicuous on the sides of the head; with a few longer (up to about 0.1 mm), finer, curved setae near eyes and bases of antennae; setae of anterior margin of frons delicate, ramose, those near middle about 0.025 mm long and branching from base (Fig. 37), increasing in size toward the sides to those near the large teeth of the margin which are about 0.060 mm long (extending well beyond the teeth) and branching all along the length of the main axis (Fig. 38); tubercles of anterior margin of frons forming a row of blunt spines ranging in length from about 0.007 to 0.018 mm, those near the lateral teeth being larger; epicranial tubercles mostly double on anterior two-thirds of head, each bearing an inconspicuous seta; epicranial tubercles on basal third flattened, scale-like (Fig. 39) in region normally withdrawn into prothorax.

Thoracic and *abdominal tergites* rather uniformly armored with tubercles in exposed regions, the tubercles mostly bicuspid and somewhat larger than those of the head. Pronotum with major cusps of tubercles directed anteriorly except along posterior margin; near basal third of pronotum on each side, almost halfway from midline to lateral margin, there are two small granular patches devoid of tubercles, a seta arising from the more dorsal one. Other isolated setae arise from the anterior and lateral margins. Mesonotum, metanotum, and abdominal tergites with tubercles directed posteriorly, the surface between the tubercles being alutaceous. Each segment with an isolated lateral, laterodorsal, and dorsolateral seta on each side. Each of these segments with anterior border (in the portion which can be retracted within the preceding segment) devoid of tubercles except for a single row which probably serves an anchoring function (Fig. 45); this region appears alutaceous at low magnification but is composed of flattened scales which are imbricate on at least parts of these "collars" on the mesonotum, metanotum, and first two abdominal tergites. Posterior margin of all segments except ninth bordered by a close-set row of tubercles from which arise flattened setae which project inward and posteriorly; these setae appear to overlap and grip the anterior row of tooth-like tubercles (Fig. 45) of the succeeding segment. Similar transparent setae project forward beneath the anterior margin of the pronotum.

Prosternum alutaceous, with tubercles directed anteriorly as on pronotum, but more widely separated, especially near anterior median border where the marginal tubercles are flattened and truncate (Fig. 40). Mesosternum and metasternum alutaceous, the anterior two-fifths partially covered by imbricate scales; tubercles restricted to raised antecoxal region and pleurites, though the anterior pleurite on each segment is almost devoid of tubercles; tubercles directed posteriorly. Median region of mesosternum, metasternum, and anterior part of first abdominal sternite slightly raised, forming a modest carina. On abdominal segments one to



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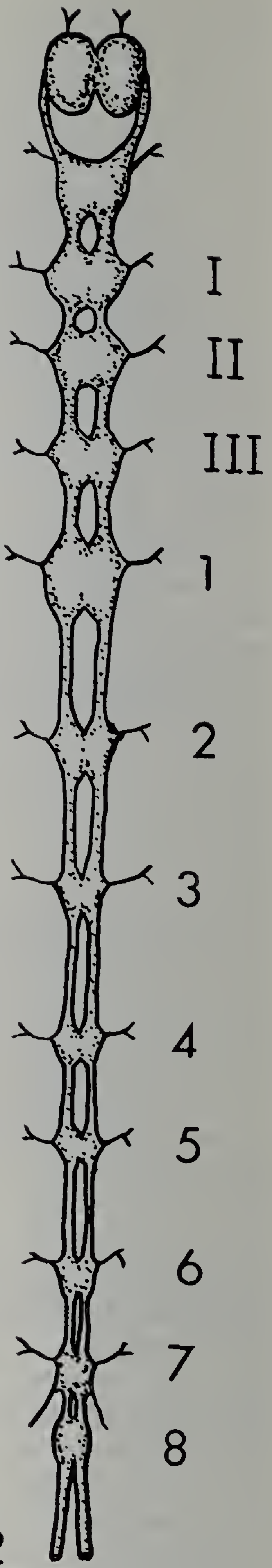

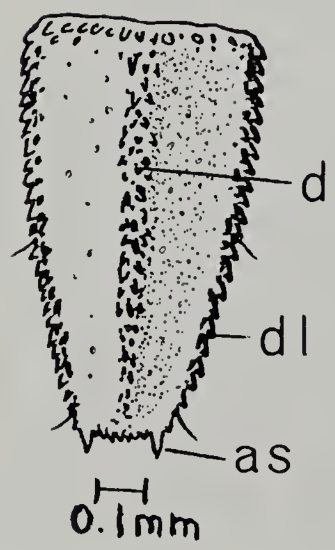

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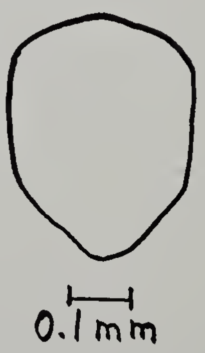

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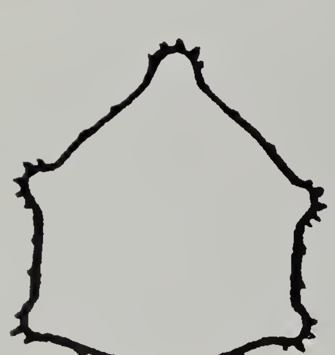

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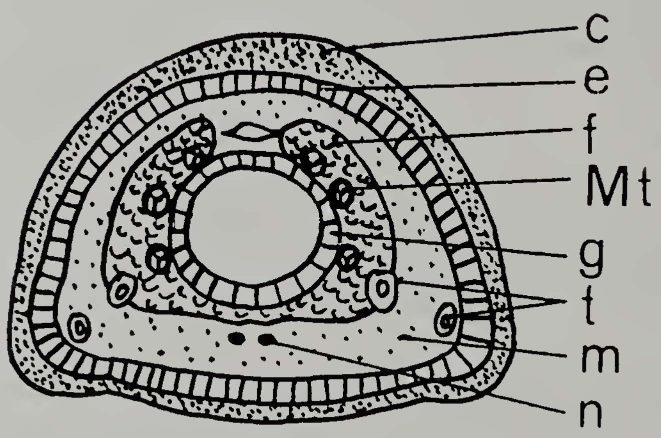

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Fig. 47. *N. boeseli* sp. n., ninth abdominal segment of larva, lateral aspect. Key to abbreviations: *d*—dorsal carina, *dl*—dorsolateral carina, *vl*—ventrolateral carina, *o*—operculum (slightly open), *o c*—opercular claw, *a s*—apical spine or tooth.

Fig. 48. *N. boeseli* sp. n., ninth abdominal segment of larva, dorsal aspect. Abbreviations as in Fig. 47.

Fig. 49. *N. boeseli* sp. n., operculum of ninth abdominal segment of larva, ventral aspect.

Fig. 50. Diagram of a cross section through the ninth abdominal segment of a mature larva of *Neocylloepus* sp. to show the relationships of the carinae.

Fig. 51. Diagrammatic cross section through abdomen of mature *Neocylloepus* larva. Abbreviations: *c*—cuticle, *e*—epidermis, *f*—fat body, *M t*—Malpighian tubule, *g*—gut, *t*—tracheae, *m*—muscle, *n*—nerve cord. (Adapted from a drawing by Mr. Edwin A. Green.)

Fig. 52 Diagram of central nervous system of mature larva of *Neocylloepus*. Thoracic ganglia are indicated by Roman numerals; abdominal ganglia are indicated by Arabic numerals. (Adapted from a drawing by Mr. Edwin A. Green.)

eight, the posterior margins of the sternites and pleurites are bordered by small tubercles which are usually tricuspid, the median cusp being longest. Ninth abdominal segment (Figs. 47, 48) on each side with lateral margin of apex projecting posteriorly as a prominent tooth about 0.04 to 0.05 mm long, fringed with inconspicuous transparent setae. Margin between teeth bordered by smaller, tooth-like, projecting tubercles. Leg (Fig. 44) and operculum (Fig. 49) as figured. Lateral apex of coxa usually produced. Spiracles opening on small tubercles. Larvae of earlier instars lack the spiracles and white lateral line, as well as exhibiting smaller dimensions. Those I have observed are also less dusky in coloration, being essentially testaceous.

Specimens: U. S. A.: Texas—Devil's River about 20 miles south of Juno: 5 larvae collected in August, 1967, and 28 larvae collected at the same locality in May, 1969. Most of these are mature.

Comparative notes: This larva differs from the others in its larger size, more prominent apical teeth on the last segment, proportionately narrower head, tricuspid tubercles on the posterior margins of abdominal sternites with the middle cusps predominant, and in having typically only two bare patches (devoid of tubercles) on each side of the pronotum. It also appears to differ in having at least a few small tubercles on the anterior pleurites of the meso- and metathorax, although these are very difficult to observe.

Description of Mature Larva of *N. sculptipennis* (Sharp)

Length, 3.4-4.2 mm; breadth across prothorax 0.60-0.63 mm; across mesothorax 0.625-0.64 mm, across metathorax 0.65-0.675 mm, across first 4 abdominal segments 0.675-0.72 mm. Ninth abdominal segment about 0.7-0.8 mm long, the apical teeth ranging from about 0.005 to 0.025 mm long. Head about 0.395 mm wide and 0.355 mm long, with the lateral teeth of the anterior margin of the frons 0.02-0.04 mm long. Labium about 0.213 mm long and 0.192 mm wide; widest near middle, tapering anteriorly from this point. Pronotum with several (3 or 4) small bare patches on each side. No tubercles observed on anterior pleurites of meso- and metathorax. Tubercles of posterior margins of abdominal sternites appear bicuspid, or if tricuspid, the middle cusp does not predominate. Except for the features mentioned above, the description of the larva of *N. boeseli* sp. n. applies to this species insofar as I have been able to observe. The immature larvae also differ from the mature ones in the same respects, i.e., no spiracles or white lateral line, testaceous coloration.

Specimens: MEXICO: Estado de Chiapas—north of Arriaga, 1 larva in October, 1966; Estado de Guerrero—1 near Xaltianguis and 1 near Playon in March, 1969; west of El Ocotito, 35 in April, 1969; south of Tierra Colorada, 7 in April, 1969; near El Cuarenta, 2 in April, 1969. GUATEMALA: Departamenta de El Progreso—near San Cristobal Acastoquastlan, 1 in October, 1966.

Comparative notes: This larva differs from that of *N. boeseli* sp. n. in having more than two bare patches on each side of the pronotum, no tubercles on the anterior pleurites of meso- or metathorax, and tubercles lining the posterior margins of abdominal sternites 1-8 which lack a prominent central cusp. From the larva of *N. sandersoni* sp. n. it differs in possessing distinct apical teeth on the ninth abdominal segment and in being proportionately slenderer.

Description of Mature Larva of *N. sandersoni* sp. n.
(Figs. 35, 36)

Length, 3.50-4.20 mm; breadth across prothorax 0.60-0.65 mm, across mesothorax 0.65-0.70 mm, across metathorax 0.67-0.73 mm, and across first 4 abdominal segments 0.72-0.75 mm. Ninth abdominal segment 0.73-0.75 mm long, with no apical teeth or with but rudiments of teeth. Head about 0.47-0.50 mm wide. Midventral carina of mesothorax, metathorax, and first abdominal segment poorly developed as in *N. sculptipennis.* In other respects, the description of *N. boeseli* sp. n. applies reasonably well to this species. Again, the immature larvae differ from the mature ones as described for *N. boeseli* sp. n.

Specimens: COSTA RICA: Provincia de Puntarenas—small river west of Canoas, 6 in November, 1966. PANAMA: Provincia de Panama—Rio Pacora north of Pacora, 4 in June, 1968.

Comparative notes: This larva is distinctive in lacking apical teeth on the ninth abdominal segment; it is also proportionately broader than either of the other species described above.

ACKNOWLEDGMENTS

This investigation was supported in part by the Faculty Research Fund of The University of Oklahoma. Figures 51 and 52 are based upon drawings provided by Mr. Edwin A. Green, who is engaged in a study of the comparative morphology of dryopoid larvae.

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DESCRIPTORS: Coleoptera; Dryopoidea; Elmidae; Neocylloepus; new genus; description; keys; new species; Texas, Mexico, Central America.

2.0001. *Neocylloepus,* a new genus from Texas and Central America (Coleoptera: Dryopoidea: Elmidae)

ABSTRACT—The genus *Neocylloepus* is created to include *N.* (*Elmis*) *sculptipennis* Sharp 1882, *N. hintoni* (=*Cylloepus sculptipennis* as redescribed by Hinton, 1940) in the Mexican states of Mexico and Morelos, *N. boeseli* from Devil's River, Texas and the state of Nuevo Leon, Mexico, *N. arringtoni* from Rio Axtla in southeastern San Luis Potosi, Mexico, *N. petersoni* from northern Chiapas, Mexico, and *N. sandersoni* from Costa Rica and Panama. The range of the type species, *N. sculptipennis,* extends from the state of Nayarit in Mexico through Guatemala and Honduras to northwestern Nicaragua. Two of the new species being based upon unique male specimens, the species key is based largely upon male characters, especially those of the genitalia. *N. hintoni* is based upon Hinton's description. Types of the other 4 new species are deposited in the Stovall Museum of Science and History, Norman, Oklahoma. A total of 142 adults and 91 larvae were examined. Since both adults and larvae key out to various other genera (*Cylloepus, Elsianus, Microcylloepus,* and *Neoelmis*) in existing keys to the elmids of Mexico and the United States, modifications of the keys of Arnett, Bertrand, Hinton, Leech and Chandler, and Leech and Sanderson are presented for the insertion of *Neocylloepus.* This genus is probably closest to *Hexacylloepus.*—H. P. BROWN.

FIELD NOTE

3.0002 **Additional Distributions for Species of Phratora Chevrolat.**—The genus *Phratora* Chevrolat has been revised by Brown (1951, Canadian Entomol., 88, pp. 121-130), who also recorded new distributions for this genus in two subsequent papers (1952, Canadian Entomol., 84, pp. 335-342; and 1961, Canadian Entomol., 93, pp. 967-977). A study of specimens in the South Dakota State University Insect Collection and those collected by the author has shown some interesting new distributions.

Of prime interest is *Phratora interstitialis* Mannerheim. A single male of this species was collected by sweeping at Crooks Tower Lake in the Black Hills, Lawrence County, South Dakota, August 4, 1967, elevation 7140 feet. No host plant was noted. Both external characters and features of the aedeagus refer it to this species. Heretofore easternmost records were from Great Slave Lake, Northwest Territories, and southernmost from east-central British Columbia. Thus, this specimen, in addition to simply being a new state record, represents an extension of range of more than 950 miles.

Brown (1961) indicated that the range of *Phratora frosti remissa* Brown included the Black Hills, South Dakota. I have collected five Black Hills specimens in Lawrence County, South Dakota, and the S.D.S.U. Insect Collection contains six other specimens: five from Medicine Bow Lodge, Colorado, and one from Sherridon, Manitoba.

A third South Dakota *Phratora* species is *P. purpurea purpurea* Brown. The following records for this species represent the southwesternmost known distribution and also a new state record. Although recorded from as far west as British Columbia *P. p. purpurea* has, until now, been reported no further south than eastern Ontario, or, in the Midwest, Riding Mountain, Manitoba. The South Dakota records now extend its range at least 460 miles. This material includes the following Black Hills specimens: two from Sylvan Lake, Custer County (previously determined by H. S. Barber as *P. americana* Schaeffer, prior to Brown's recognition of *P. purpurea* as a distinct species), one from Sturgis, Meade County; three from Lead, twelve from Pluma, twelve from Englewood, five from Hanna Campgrounds, Lawrence County; and one from Mickelson and three from Ditch Creek (four miles south of Deerfield), Pennington County. One specimen from 100 miles east of the Black Hills, Kennebec, Lyman County, also is in the S. D. S. U. collection. An additional new state record for this species is a single specimen, which I collected ten miles south of Red Lodge, Carbon County, Montana. Edward U. Balsbaugh, Jr., South Dakota State University, Brookings, South Dakota 57006.

DESCRIPTORS: Coleoptera; Chrysomelidae; Phratora; S. Dak., Mont., Col., Manitoba, B. C.

3.0003 Tribal Placement Of Acmaeoderoides And Other Notes (Buprestidae)

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KANSAS CITY COLLEGE OF OSTEOPATHY AND SURGERY
KANSAS CITY, MISSOURI

In the recent revision of *Acmaeoderoides* (Nelson, 1968) that genus was left in the tribe Acmaeoderini where Van Dyke (1942) placed it near the genus *Acmaeodera*. This overlooked the work by Cobos (1955), in which the tribal placement of *Acmaeoderoides* was studied and a new tribe Acmaeoderoidini was erected for its inclusion. The characteristics that were used to separate the tribe Acmaeoderoidini from Acmaeoderini may be tabulated as follows:

Acmaeoderoidini	*Acmaeoderini*
Scutellum visible	Scutellum invisible
Elytra free	Elytra fused
Epipleura more or less hypertrophied toward the base	Epipleura normal or more or less low cut below the shoulder
Suture asymmetrical	Suture symmetrical

The tribe Acmaeoderoidini, according to Cobos' study, belongs nearest the tribe Nothomorphini but differs as follows: Acmaeoderoidini has propleura triangular, prosternum without lobe, and membranous wing with anterior radial cell; Nothomorphini has propleura subparallel, prosternum with more or less well developed lobe, and membranous wing without anterior radial cell.

Acmaeoderoides insignis (Horn), 1894, Proc. Calif. Acad. Sci., ser. 4, 4:377. This species was collected by R. L. Westcott and D. S. Verity at Dos Palmas Springs, Riverside Co., Calif., 26 March and 9 April 1968, on blossoms of *Phacelia crenulata* Torr. This is the first authentic record of this species from California. The elytra of some have a definite reddish color and basal setae of the elytra that are more flattened than on specimens previously examined from Baja California. In size the males of this series vary from 3.75 to 4.5 mm in length and the females from 4.0 to 5.0 mm.

Acmaeoderoides verityi Nelson, 1968, Proc. Calif. Acad. Sci. 36 (6):125-146. A moderate series of this species was collected by D. S. Verity and G. C. Walters, 13-15 miles east of Valle de Trinidad, Baja California, Mexico, 26 May 1968. This sample, the first from Baja California, is generally larger than the type series with the largest male being 5.5 mm and the largest female 6.0 mm in length. The fourth antennal segment of the male is more distinctly serrate than in the type series but not so distinctly as in *insignis* (Horn).

Acmaeoderoides humeralis (Cazier), 1938, Bull. South. Calif. Acad. Sci.

37:12. A female of what appears to be this species was taken in Santa Elena Canyon, Big Bend Nat'l Park, Texas, 18 July 1966 by A. E. Lewis. This species has previously been taken only in southern California.

Acmaeoderoides rufescens Nelson, 1968, Proc. Calif. Acad. Sci. 36 (6):125-146. This species was taken by D. S. Verity and G. C. Walters, 13-15 miles east of Valle de Trinidad, Baja California, Mexico, 26 May 1968, on blossoms of *Palafoxia*. This is the first record for this species from Baja California.

ACKNOWLEDGMENTS

Thanks are extended to Messrs. David S. Verity, George C. Walters, and Richard L. Westcott for allowing the writer to mention new records from their collections.

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DESCRIPTORS: Coleoptera; Buprestidae; Acmaeoderoides; classification; distribution; California, Texas, Mexico.

3.0004 A New Name for Cicindela cyanocephalata Eckhoff (Coleoptera: Cicindelidae)

DEAN E. ECKHOFF, GERING, NEBRASKA 69341

When I published "The Cicindelidae of Iowa" in 1939 (*Iowa State Coll Jour Sci* 13:201-230) I offered *cyanocephalata* Eckhoff as a replacement name for the homonym *cyanocephala* Varas y Arangua (1929 *Revista Chilena Hist Nat* 32:239) preoccupied by cyanocephala Fabricius (1798 *Supplementum Entomologiae Systema,* Hafniae, p60). My paper was picked up by the *Zoological Record* but overlooked by both *Biological Abstracts* and the fifth supplement to Leng's *"Catalog."* Most American students are apparently still unaware of the homonymy and equally unaware of my replacement name.

The latest Rules of the International Commission contain an appendix of recommendations regarding the formation of new names. These recommendations are not mandatory but are followed in good faith by most zoologists. To avoid any further confusion which might result when future workers research the synonymy of Nearctic *Cicindelae,* I feel it appropriate to adhere to Appendix D (I)7: "A zoologist should not choose a new species-group name differing from one in the same or in an allied or associated genus in being an adjective instead of a noun or vice versa; this applies also to the terminal element of a compound name, e.g., *cauda: caudatus, caudata, caudatum,* etc."

Because my 1939 replacement name was simply the adjectival form of the noun employed by Fabricius and later Varas y Arangua, I hereby propose the more "acceptable" replacement name *cyanocephalonota* Eckhoff, indicating that the pronotum, as well as the cephalic capsule, is blue.

I wish to thank Mr. Ronald L. Huber of St. Paul, Minnesota, for suggesting the need for another replacement name and for helping me in the preparation of this note.

DESCRIPTORS: Coleoptera; Cicindelidae; Cicindela; classification.

Notice

Beginning with this issue of the Bulletin we shall begin a new publication plan for systematic entomology, Data Documents (See Arnett, 1970). Using this system documents are stored in a data document center for reproduction and distribution as needed. That such documents exist is shown by their appearance in the parent journal either by complete publication, by title and abstract, or only by title. Descriptors are provided by the author of each article. These will serve as retrieval codes for each document for automatic data processing.

Authors of articles submitted to this journal are requested to submit an abstract of their article not to exceed 1600 spaces and a set of descriptors for each modelled after the lead article in the March 1970 issue of the Coleopterists' Bulletin.—N.M.D.

Reference

ARNETT, R. H., JR. 1970. Data Documents, a new publication plan for systematic entomology. Ent. News 81: 1 11.

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9. Studies on Speciation No. 1: The taxonomy and speciation of Pseudophonus. Institute for study of Natural Species, 550 Elston Road, Lafayette, Indiana 47905. $3.95.

Notices

CARABIDAE: Will exchange French beetles of families Scarabaeidae, Histeridae, Buprestidae, Chrysomelidae, Coccinellidae, Anthicidae, Tenebrionidae, and water beetles for U. S. Carabids. Jacques Negre, 9, Bd. De Lesseps, Versailles, France.

SCARABAEIDAE: Interested in obtaining specimens of the genus *Coenonycha* for research and in building up a collection of scarab genera from the U.S.A. Exchange. Mrs. Jean Davidson, Dept. of Entomology, Oregon State University, Corvallis, Ore. 97331.

BUPRESTIDAE: Will exchange specimens and determine *Chrysobothris* from southwestern U.S.A. Jerry Davidson, Dept. of Entomology, Oregon State University, Corvallis, Oregon 97331.

CARABIDAE, SCARABAEIDAE: Collect, exchange. William D. Harding, 4365 Midland, Drayton Plains, Mich. 48020.

SCARABAEIDAE: Limited number of *Pleocoma badia* available. Terry W. Taylor, 8529 Norwood Pl., Rosemead, CA 91770.

ELATERIDAE: Revising *Physorhinus*, wish to borrow pinned or alcohol material. D. Schaaf, Dept. of Entomology, Purdue University, Lafayette, Indiana 47907.

STAPHYLINIDAE: Currently beginning study of taxonomy and morphology of larvae and adults of the Staphylinid subfamily Leptotyphlinae. Would like to borrow specimens in this group from North America primarily, but would welcome material from Central or South America. J. F. Cornell, Ass't Prof. of Biology, Appalachian State University, Boone, N. Car. 28607.

TENEBRIONIDAE: Will exchange South American, Andean, and desert forms for any other groups of insects from Chili. Luis. D. Pena, G.P.O. Box 2974, Santiago, Chile.

CICINDELIDAE: Interested in obtaining specimens of Cicindela trifasciata peruviana from Peru and Ecuador. Will exchange for other Chilean species. Luis E. Pena, G.P.O. Box 2974, Santaigo, Chile.

SCARABAEIDAE, CERAMBYCIDAE, LUCANIDAE: Goliath beetles, 14 different aberrations; 200 other species of beetles; for sale. Russell Dunn, Box 468, Sedona, Arizona, 86336.

VIET NAM COLLECTION: Will exchange recently collected material from S.E. Asia for material from Southwestern U.S.A. Anyone wishing to determine material from this collection may keep the determined specimens. Bruce W. Miller, Dept. of Biological Sciences, Univ. of Nevada at Las Vegas, Las Vegas, Nevada, 89109.

COLYDIIDAE: Revising the family for America north of Mexico. Wish to borrow material; will exchange for other Coleoptera. Karl H. Stephan, 3038 E. Eastland, Tuscon, Ariz., 85716.

LIMNEBIIDAE: Revising the genus *Ochthebius* for North America. Desire material mounted or in alcohol. F. E. Wood, Dept. Ent., Univ. of Md., College Park, Md. 20742.

Compiling a check-list of the beetles of Clark Co., Nev. I would like to correspond with Coleopterists who have collected in southern Nevada. B. W. Miller, Dept. of Biol., Univ. of Nev. at Las Vegas, Las Vegas, Nev. 89109.

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COLEOPTERISTS' BULLETIN

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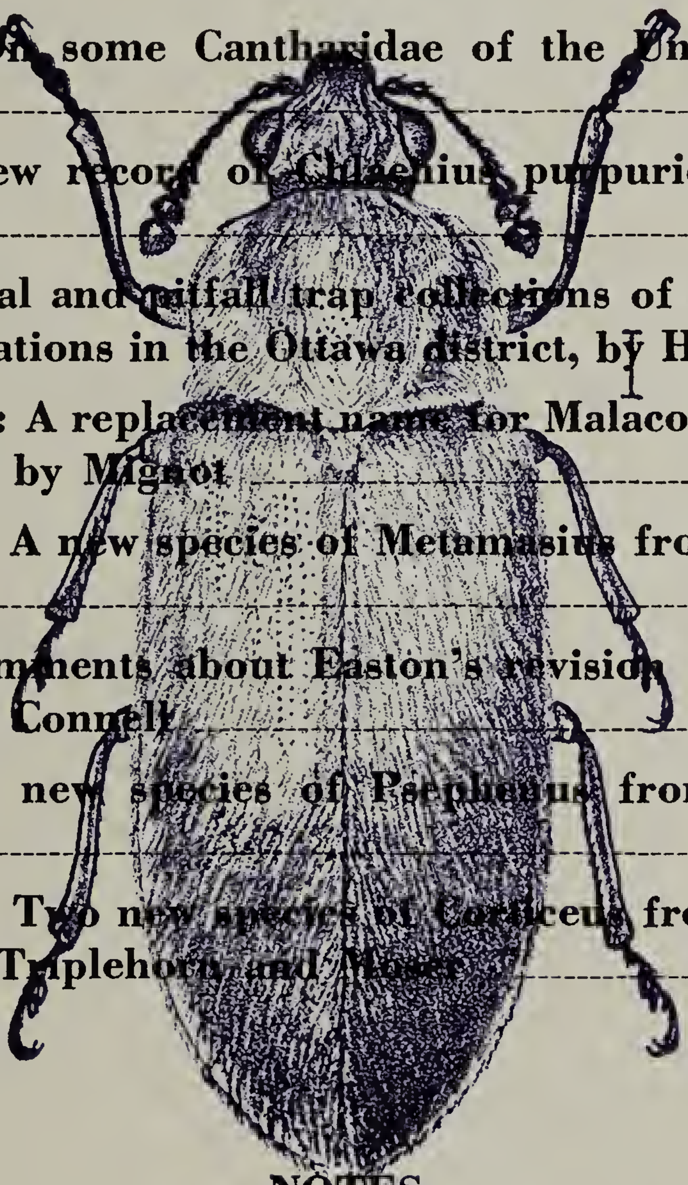

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Purdue University - Lafayette, Indiana

THE COLEOPTERISTS' BULLETIN

Founded 1947 by Ross H. Arnett, Jr.

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The Coleopterists' Bulletin
VOLUME 24 JUNE 1970 NUMBER 2

3.0007 Comments About Easton's Revision of the Neartic Meligethes (Nitidulidae)[1]

W. A. Connell

Department of Entomology and Applied Ecology
University of Delaware, Newark

A. M. Easton (1955) performed a valuable service through his studies of the North American segment of the genus *Meligethes* Stephens. While only eight species are involved, the resemblance of some to certain of the more common members of the Paleartic fauna, and the naming of others without giving sufficient consideration to species described from the Paleartic, had resulted in a welter of names, three unnamed species and much confusion. We are indebted to Dr. Easton for bringing order out of this chaos.

The purpose of this note is to refer to a matter of nomenclature; to point out that although two of the more common species, *M. dauricus* Motschulsky, and *M. simplipes* Easton, are rather similar in appearance, they are widely separated geographically; and, most important, to call attention to Easton's excellent work.

The change in name to which attention needs to be directed is the result of Easton (1955) having placed *dauricus* Mots. as a subspecies of *rufimanus* Lec. In a later paper (Easton 1959), he referred to *rufimanus* as a synonym of *dauricus,* but this change seems to have been overlooked by many coleopterists. Motschulsky described *dauricus* in 1849 and *rufimanus* was not described until eight years later (Le Conte, 1857). Thus it would appear that, for this species, the name *dauricus* has priority.

M. dauricus Mots. is known in North America only from the western part of the United States and portions of Mexico. *M. simplipes* Easton is known only from Ontario, New York, New Jersey, Pennsylvania, Delaware, Maryland, Ohio, Virginia, West Virginia and Tennessee. Easton (1955) indicates that *dauricus* is related to the Paleartic species *M. aeneus* Fab., while he (1947) places *simplipes* close to the Paleartic *M. viridescens* Fab. and *M. augustatus* Kust. Both *dauricus* and *simplipes* are quite variable and there is convergence in all of the taxonomic characters described by Easton to distinguish them, so that a small percentage can be separated only through consideration of geography.

The members of this genus known from North America, together with their known distribution are:

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[1] Published as Miscellaneous Paper No. 614 with the approval of the Director of the Delaware Agricultural Experiment Station. Publication No. 397 of the Department of Entomology and Applied Ecology.

canadensis Easton—Alaska, Yukon, British Columbia, Alberta, Quebec, California, Utah and Colorado.

cleominis Easton—British Columbia to Manitoba and south to Arizona.

dauricus Motschulsky—a Holartic species, in North America present in western Canada, western United States, adjacent Mexico and east to Kansas and Nebraska.

nigrescens Stephens—a Holartic species, in North America ranging from Yukon to Oregon and Ontario in the west, and from Massachusetts to Maryland and Indiana in the east.

simplipes Easton—Ontario and eastern United States to Ohio and Tennessee.

saevus LeConte—Manitoba to Iowa and Kansas.

atratus Olivier—a Paleartic species, but a single specimen has been reported from British Columbia.

pinguis Horn—the unique type is from Newfoundland.

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DESCRIPTORS: Coleoptera; Nitidulidae; Meligethes; classification.

3.0005 A new species of *Psephenus* from Arizona (Coleoptera, Psephenidae).

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DEPARTMENT OF ZOOLOGY, UNIVERSITY OF OKLAHOMA
NORMAN, OKLAHOMA 73069

Recent unpublished work by Chad Murvosh and Paul Spangler indicates that *Psephenus calaveras* Blaisdell 1923, *P. lanei* Blaisdell 1923, *P. falli* Casey 1893, and *P. veluticollis* Casey 1893 are all synonymous with *P. haldemani* Horn 1870. Thus, at present, the Genus *Psephenus* Haldeman 1853 is represented in the United States by only three recognized species: *P. herricki* (DeKay) 1844 in the eastern states, *P. haldemani* in California, Oregon, Idaho, and western Wyoming, and *P. texanus* Brown and Arrington 1967 in southwestern Texas.

A population of *Psephenus* occurs in central Arizona which represents a new species. I hereby name it in honor of Chad M. Murvosh, who has seen larval specimens and who will probably be the next person to publish on this species.

Psephenus murvoshi Brown, NEW SPECIES

Holotype male—Length 3.2 mm, greatest width 1.6 mm (Fig. 1). Oblong-oval, moderately depressed, densely pubescent; shining above, head nigro-piceous except for testaceous area immediately posterior to eye; pronotum nigro-piceous; elytra fuscous; eyes and antennae fusco-cinereous; anterior surface of first antennal segment blackish; coxae and basal portions of femora testaceous shading to fuscous apically on the dorsal surface; tibiae nigro-fuscous; tarsi rufo-fuscous to testaceous; labrum, maxillary palps, and most ventral sclerites fusco-cinereous except for the following testaceous parts: epipleura of elytra, apical margin of fourth abdominal segment, on the fifth abdominal segment a small median basal area expanding abruptly to encompass most of the apical portion, and all the visible portions of the sixth and seventh abdominal segments; labial palps testaceous.

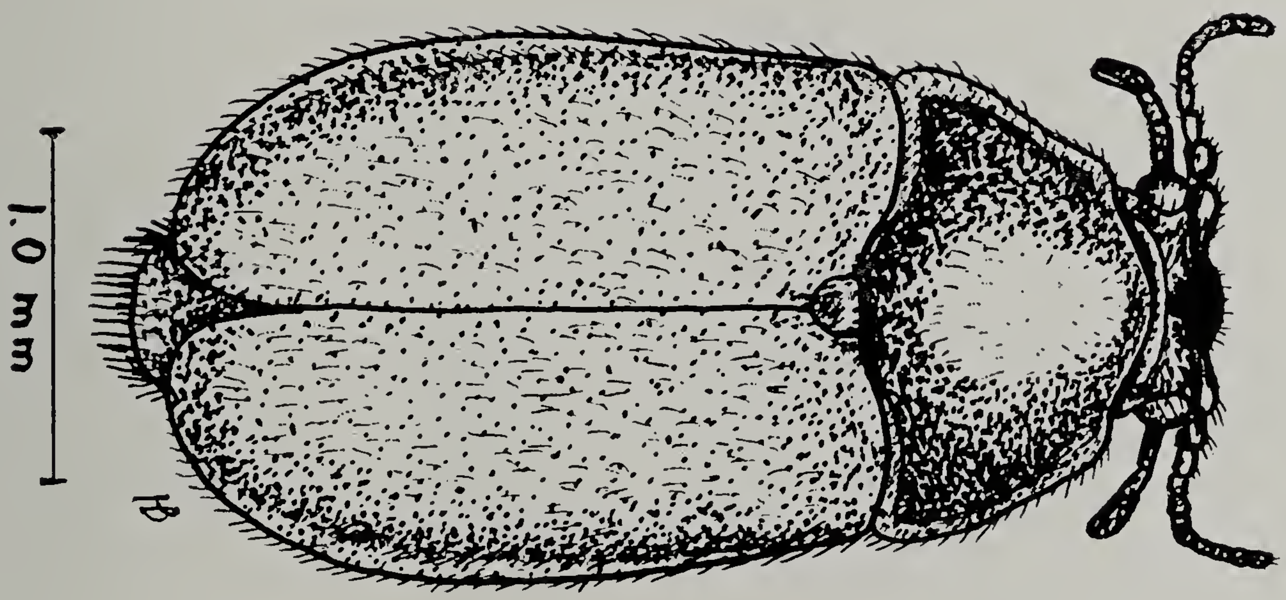


Fig. 1. *Psephenus murvoshi* Brown, new species. Dorsal aspect of male.

Head transverse, densely and minutely punctate; vertex with a median longitudinal impression which expands anteriorly to a broad concavity across the frons; with a transverse occipital ridge crossing head behind eyes; raised apical margin evenly arcuate between bases of antennae. Eyes prominent, hemispherical. Antennae short, hardly extending to base of elytra; pubescent; setae on dorsal and anterior surfaces of three basal segments most prominent; first segment longest and most inflated, second segment next in both length and width, third subequal to second in length but slenderer, fourth slightly shorter, fifth to tenth still shorter and subequal, eleventh subequal to third and with a slight apical tuft of setae (Fig. 2). Clypeus and labrum, as seen from the front, arcuately emarginate apically (Fig. 2), the labrum covered by a mustache of yellowish hairs. Maxillary palp (Fig. 2) four segmented, about three-quarters as long as antenna; basal segment smallest, about one-fifth as long as second; second segment longest and rather slender; third segment slightly over half as long as second and flaring apically; fourth segment almost as long as second, laterally compressed and expanded dorso-ventrally, the outer margin bearing a glabrous ridge which terminates apically in a loop. Labial palp testaceous, three-segmented; first and second segments broad and subequal; third segment small and white-tipped; with sparse but prominent ventrally-directed setae.

Pronotum about five-eighths as long as wide; convex; densely minutely punctate; apex feebly bisinuate, about three-fifths as wide as base; sides explanate, converging toward apex, feebly arcuate to feebly sinuate; base distinctly bisinuate; apical angles broadly rounded; basal angles bluntly acute, turned slightly inward.

Elytra widest near middle; apices separately rounded and slightly divergent; densely and minutely punctate; pubescence dense, consisting of golden hairs; sides feebly explanate, the

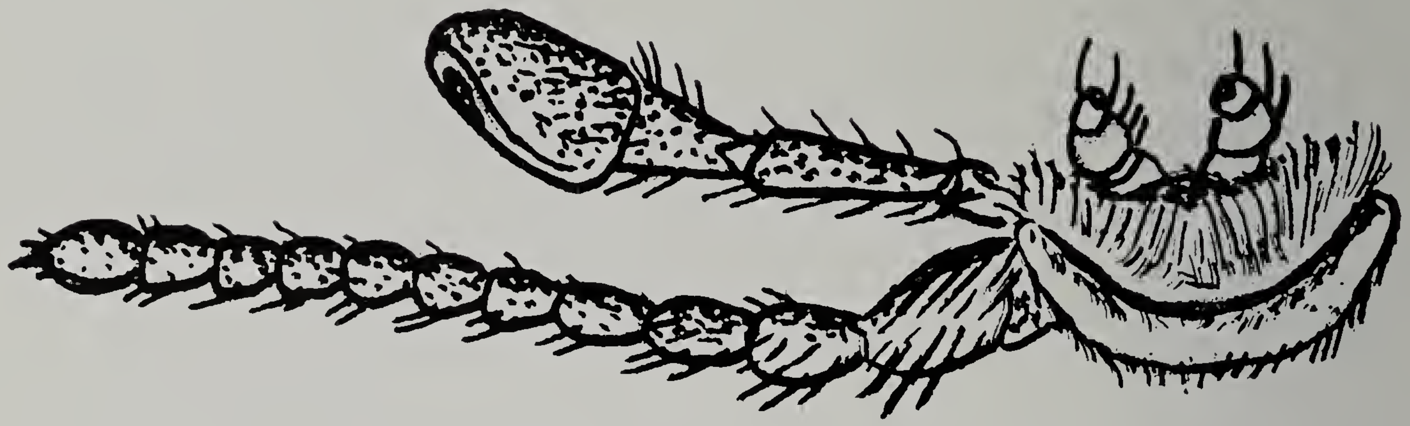


Fig. 2. *Psephenus murvoshi* sp. n. Anterior aspect of clypeus, labrum, labial palps, left antenna, and left maxillary palp.

margins paler in color. Scutellum rounded behind, slightly transverse, densely pubescent, with a feeble median impression near posterior margin.

Prosternal process long, narrow, pubescent, carinate along midline, and projecting about one-quarter of the length of the groove between the mesocoxae into which it is inserted. Fifth ventral abdominal segment arcuately emarginate, exposing the lateral apical lobes of the deeply incised sixth segment; seventh segment rounded at apex. Outer carina of fore and middle tibiae dividing or expanding slightly before middle, that of hind tibia dividing in apical quarter; tibiae slender; first segment of fore and middle tarsi with densely pubescent pad beneath; tarsal claws not perceptibly toothed at base.

Aedeagus trilobate (Figs. 3-5). Parameres broad basally, tapering to bluntly rounded apices as seen in dorsal aspect. Median lobe stout; midventral sclerotized portion ("penial spicule" of Brown and Arrington, 1967) well developed, elongate, length more than twice the width, rounded basally and acute apically. Basal piece well developed, hemicylindrical, with dorsal side open (unsclerotized).

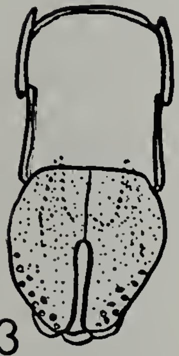
Female.—Unknown.

Holotype—U. S. A., Arizona, East Verde River near Payson, July 8, 1969, H. P. Brown. Deposited in Stovall Museum of Science and History, Norman, Oklahoma.

Comparative notes. Psephenus murvoshi sp. n. is similar to *P. usingeri* Hinton 1934 in size and general aspect, but differs in having a bicolored dorsum, distinctly different aedeagus, proportionately longer maxillary palp, apical segment of palp subequal in length to second, compressed and enlarged. The second segment of the palp in *P. usingeri* is longer than segments three and four combined (Hinton, 1934). From *P. haldemani* Horn it differs in size, being obviously smaller (specimens of *P. haldemani* in my collection range from 3.5 to 5.0 mm in length), in having a bicolored dorsum and various testaceous underparts as contrasted with the uniformly dark coloration of *P. haldemani,* and in such features of the aedeagus as the tapered parameres and broader ventral penial sclerite. *P. murvoshi* sp. n. differs from *P. texanus* Brown & Arrington in its smaller size (the latter ranges from about 4.0 to 5.5 mm), arcuate rather than bisinuate frontal margin, proportionately longer maxillary palp (that of *P. texanus* is only about half as long as antenna), and in the structure of the aedeagus (Figs. 3-5, 6-8).

Distribution. Although the holotype described above from the East Verde River in Gila County is the only specimen in my collection, I observed psephenid eggs in West Clear Creek southeast of Camp Verde in Yavapai Co. and in the Agua Fria River near Black Canyon City, Yavapai Co. Murvosh, in a paper presented at the Dallas meeting of the Entomological Society of America in 1968, mentioned receiving larval psephenids collected in Oak Creek Canyon, presumably in Coconino Co. south of Flagstaff. Since the East Verde River, West Clear Creek and Oak Creek are all tributaries of the Verde River, which parallels the Agua Fria River, both flowing into the Salt River near Phoenix, and since no other psephenids are known from the region, it is reasonable to assume that all of the records listed above represent *Psephenus murvoshi* sp. n.

The affinities of this species are probably with Mexican species, rather than with others known from the United States.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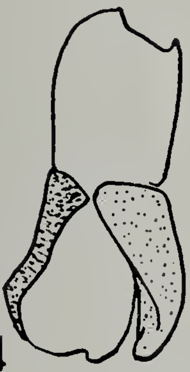
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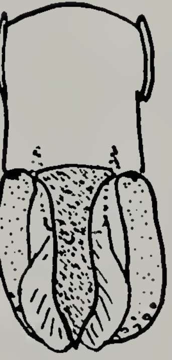
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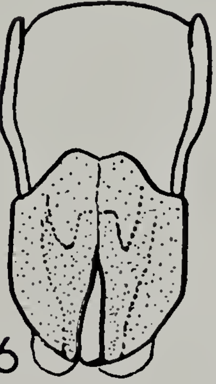
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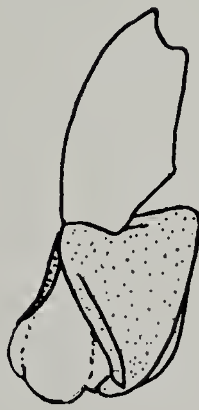
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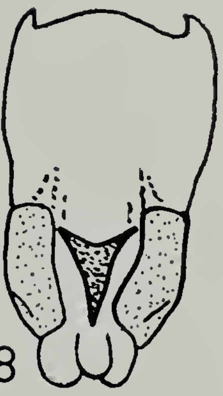
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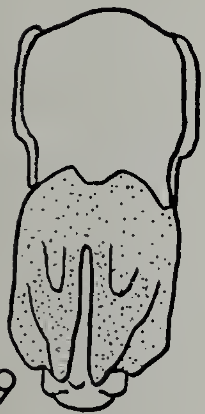
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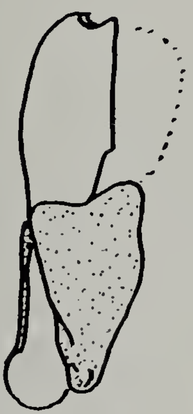
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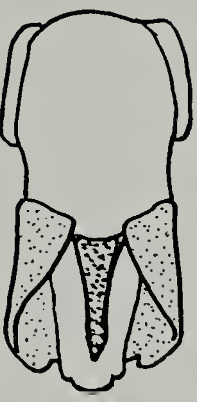
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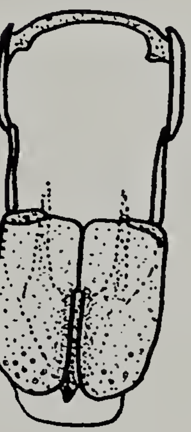
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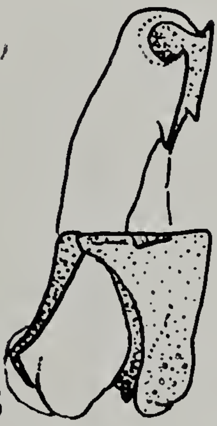
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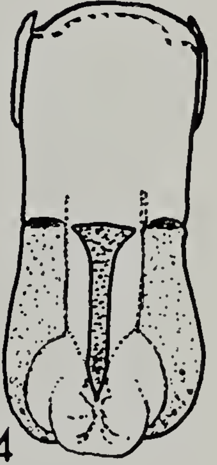
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Fig. 3. *P. murvoshi* sp. n. Aedeagus, dorsal aspect.

Fig. 4. *P. murvoshi* sp. n. Aedeagus, lateral aspect from left side.

Fig. 5. *P. murvoshi* sp. n. Aedeagus, ventral aspect. Ventral sclerite of penis heavily stippled.

Fig. 6. *P. texanus*. Aedeagus, dorsal aspect.

Fig. 7. *P. texanus*. Aedeagus, lateral aspect from left side.

Fig. 8. *P. texanus*. Aedeagus, ventral aspect.

Fig. 9. *P. herricki*. Aedeagus, dorsal aspect.

Fig. 10. *P. herricki*. Aedeagus, lateral aspect from left side.

Fig. 11. *P. herricki*. Aedeagus, ventral aspect.

Fig. 12. *P. haldemani*. Aedeagus, dorsal aspect.

Fig. 13. *P. haldemani*. Aedeagus, lateral aspect from left side.

Fig. 14. *P. haldemani*. Aedeagus, ventral aspect.

KEY TO SPECIES OF PSEPHENUS IN THE UNITED STATES
(Based upon male specimens)

1. Anterior margin of head distinctly bisinuate; ventral sclerite of penis almost as wide as long, emarginate at base (Figs. 6-8); in southwestern Texas .... **P. texanus** Brown and Arrington 1967

Anterior margin of head not distinctly bisinuate, usually arcuate; ventral sclerite of penis at least twice as long as wide 2

2 (1) Maxillary palp about half as long as antenna; ventral sclerite of penis emarginate at base (Figs. 9-11); in eastern states, extending south and west to eastern Oklahoma .... **P. herricki** (DeKay) 1844

Maxillary palp distinctly longer (two-thirds to three-fourths as long as antenna); ventral sclerite of penis arcuate at base 3

3 (2) Coloration uniformly dark; maxillary palp about two-thirds as long as antenna; total length about 3.5-5.0 mm; tarsal claws toothed at base; ventral sclerite of penis slender, parameres of aedeagus subparallel in dorsal aspect (Figs. 12-14); in California, Oregon, Idaho, western Wyoming .... **P. haldemani** Horn 1870[1]

Dorsum bicolored; epipleura, bases of femora, etc. light in color; maxillary palp about three-quarters as long as antenna; total length less than 3.5 mm; tarsal claws not appreciably toothed at base; ventral sclerite of penis relatively broad, parameres with lateral margins tapering distally from near middle (Figs. 3-5); in central Arizona .... **P. murvoshi** Brown, NEW SPECIES

ACKNOWLEDGMENTS

This study was supported by the Stovall Museum of Science and History, University of Oklahoma, Norman, and by the Faculty Research Fund of the University of Oklahoma.

LITERATURE CITED

BROWN, H. P. and R. ARRINGTON, JR. 1967. A new species of *Psephenus* from Mexico and Texas (Coleoptera, Dryopoidea, Psephenidae). Coleop. Bull. 21 (3): 86-91.

HINTON, H. E. 1934. *Psephenus usingeri,* n. sp. from Mexico with notes on the regional *Ps. palpalis* (Coleoptera, Psephenidae). Ann. Ent. Soc. America 27 (4) 616-618.

[1] *Note added in proof:* In a telephone conversation concerning this manuscript, Dr. Murvosh questioned the validity of the record of *Psephenus haldemani* from western Wyoming, suggesting that the larval specimens upon which the record was based were probably those of *Eubrianax* since they were taken at elevations well above those recorded for North American species of *Psephenus.* He also reported the finding of adult specimens of *Psephenus haldemani* in Oak Creek, Arizona, which would indicate that my surmise as to the distribution of *P. murvoshi* sp. n. and the identity of the larvae he has seen from Oak Creek are probably in error. Thus, the only definite locality for this new species is the type locality.—H. P. B.

ABSTRACT

BROWN, HARLEY P. (Department of Zoology, University of Oklahoma, Norman, Okla. 73069) A new species of *Psephenus* from Arizona (Coleoptera, Psephenidae). Coleop. Bull. *P. murvoshi* Brown, sp. n., is described from the East Verde River near Payson, Arizona. The unique holotype male specimen is deposited in the Stovall Museum of Science and History, Norman, Okla. A key includes illustrations of the male genitalia of all species of *Psephenus* known to occur in the United States.—Author.

DESCRIPTORS: Coleoptera; Psephenidae; new species; Okla., Tex., Ariz., Cal., Ida., Ore.

3.0006 Notes And Observations On The Buprestidae[1] (Coleoptera)

FRANK M. BEER

OREGON STATE UNIVERSITY

Field observations, collections and information obtained from laboratory rearings during the past several years have yielded biological and ecological information about several buprestids that appears to be worthy of record.

One such observation, first noted among some of the *Chrysobothris* in southern Oregon during the summer of 1939, involved a rather rapid thumping of the abdomen of the adult against twigs of the host plant (1). The significance of this behavior was not immediately apparent, nor has an explanation of the activity been seen in the literature. In the fall of 1966, I returned with wood containing larvae from several points visited, one being the Florida Keys. The trees, known as the Australian pine (*Casuarina equisetifolia* L.) had been badly broken by a hurricane and were extensively infested with buprestid larvae. During August and September 1967 and again in 1968, specimens of *Polycesta abdita* Barr emerged. Since the wood was not caged, specimens escaped into the laboratory and concealed themselves on and under chairs, tables, in cupboards, etc., and if not found until the day following emergence, they displayed the same tapping activity noted in *Chrysobothris.* However, the tapping of *P. abdita* was readily audible throughout the room, primarily because of its larger size and the resonating quality of the furniture. The action was performed by both sexes, and it became obvious that the tapping was a sexual activity used in locating a mate. Two or more specimens on the same object, such as a chair or table, increased both their tapping and activity, both sexes searching about for the respondent to their signals, however, the male response was the more apparent. It was also possible to locate unseen specimens by tapping with a pencil rather rapidly, but gently, on a table or chair. This produced a vibration of about the same quality and pitch as that of the insect. More often than not, an answer would be received from the free specimens. It would be interesting to know to what extent this may occur in other species in the family.

Males of a number of species of the genus *Buprestis* are seldom collected, and then usually by accident (6). In mid-July of 1966 along highway 20-38 near Lost Lake, Linn County, Oregon, while observing the activity of female *Buprestis langi* Mann. on recently cut Douglas fir (*Pseudotsuga menziesii* (Mirb.) Franco) logs, one was noted to fly into a nearby clump of willows. Her movement caught my attention and she was kept under surveillance. Within a few minutes a second beetle was observed directing its flight and attention toward the exact location of this female. These were collected, and as presumed, one was a male. My entire attention was then directed to the willow clump. In a little more than an hour, seven males were collected, more than in twenty years of beating and sweeping. Further collecting now permits the conclusion

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[1] These observations were partly financed by Oregon State University grant-in-aid funds.

that the females oviposit on logs of the Douglas fir and yellow pine (*Pinus ponderosa* Dougl.), flying to nearby plants for mating. This no doubt, explains the fact that willows of our area have been proposed as host plants. On two occasions I have beaten B. langi from willows, though once a mating pair was beaten from a black cottonwood shrub (*Populus trichocarpa* T. & G.).

In another member of this genus, *B. adjecta* LeC., males seldom occur in collections. In 1965 on Mary's Peak, Benton County, Oregon, in an area where the 12 October 1962 storm had blown down a mature stand of Douglas fir, a pair of *Bupre tis adjecta* was beaten from a clump of ocean spray (*Holodiscus discolor* (Pursh.) Maxim.). Females have been observed to fly into bushes of ocean spray and vine maple (*Acer circinatum* Pursh.), and though a good many females have been collected on logs, I have taken only the one male. I have also collected many females of *B. gibbsi* LeC., but no males. Females come readily to standing or felled dead, weatherbeaten Oregon oak (*Quercus garryana* Dougl.). It appears that males remain in the upper foliage of the oaks where they await the arrival of the females. Males of *gibbsi* have been taken in weevil traps (4) along woods north of Corvallis, but to my knowledge, none have been captured in conjunction with females. On the other hand, males of *B. aurulenta* L., *subornata* LeC., *rusticorum* Kby., and *laeviventris* LeC., are commonly found crawling over recently felled timber, apparently in search of females, since mating pairs are occasionally found.

Poecilonota montana Chamb. is a common inhabitant of living black cottonwood trees in which the larvae tunnel through the bark. Evans (5) proposed that the larvae of *Poecilonota* worked in the wood, based on information of previous writers, but no evidence of *montana* extending their tunnels into the wood has been found. With chisel and hammer I have followed the tunnels from the pupal cell, near the surface of the bark, back through a relatively short distance (seldom more than 6 to 8 inches), making the galleries remarkably short of such a large insect. The majority of the activity is near the outer surface of the living phloem, where they feed throughout most of their larval life. Trees examined ranged from around 14 inches up to nearly 24 inches DBH, and emergence openings are relatively common. Adults begin to emerge in mid-July and continue active through August. During the warm afternoons they descend to the lower 15 to 20 feet of most trees, probably because of the thicker bark, seeking crevices in which to oviposit. Here they can be easily collected, often without the use of a net. If disturbed, they generally drop from the trunk and fly off a short distance, usually into the grass. However, if the beetles are eight or more feet above the ground when disturbed, they may be able to take wing and reach a neighboring tree, occasionally out of reach. During the summer of 1964, my wife and I collected more than 50 specimens from eight trees along a roadside approximately five miles southeast of Corvallis, indicating that in our area at least, the species is rather common.

Trachykele blondeli Mars. occurs abundantly throughout the Northwest where it mines the outer sapwood of the western red cedar (*Thuja plicata* Donn.). It is reported to have been taken from several other trees, especially the incense cedar (*Libocedrus decurrens* Torr.) (2, 3) but careful examination of many of these trees has thus far produced no evidence of its use by this beetle. However, the species does use the Port Orford cedar (*Chamaecyparis lawsoniana* (Murr.) Parl.) as a host, 23 typical specimens having been cut out of this plant on March 14, 1966. They were taken from a scar in a dying tree in the Elk Creek Recreation Area along highway 199, about five miles south of the Oregon-California border. The tree, about 30 inches diameter DBH, had been injured, apparently by a bulldozer or logging truck, and the larvae had entered through the scar, which was approximately eighteen inches square and about four to five feet above the ground. Other Port Orford cedars in the area also had emergence holes in dead limbs, and one specimen was taken from its pupal cell in the dead top of a tree blown down by the wind. It is of special interest that this species has also moved into ornamental cedars (*Thuja occidentalis* L. pyramidal); a dead and living specimen have been cut out of stems of plants growing on the Oregon State University campus, and emergence tunnels have been noted in trees planted in a cemetery in Salem, Oregon. *T. blondeli*, and in fact, all members of this genus, seldom appear in collections. Adults apparently spend most of their time at considerable heights in trees, and may also be wary of the approach of man (7), yet, judging from the numbers cut out of their pupal cells, I am convinced that they are relatively abundant.

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DESCRIPTORS: Coleoptera; Buprestidae; Polycesta; Buprestis; Poecilonota; Trachykele; Fla., Cal., Ore.

3.0009 On some *Cantharidae* (Coleoptera) of the United States

W. WITTMER

NATURHISTORISCHES MUSEUM BASEL, SWITZ.

The tribe *Omethini* as understood by Arnett and Fender in "The Beetles of the United States", 1963 needs revision.

The genus *Spathizus* Lec. included in *Omethini* should be removed from this tribe. As a matter of fact *Spathizus* Leconte (1884) falls into synonymy with *Thinalmus* Gorham (1881). *Thinalmus* again can only be considered as a subgenus of *Tytthonyx* Leconte (see: Wittmer, Mitt. Schweiz. Ent. Ges. 30, 1957, p. 154). Therefore *Spathizus bicolor* (Leconte) must be transferred to *Tytthonyx* subg. *Thinalmus.*

For *Tytthonyx* Arnett has created the tribe *Tytthonyini,* the correct name should be *Tytthonyxini,* to which *Thinalmus* should be added. For the moment I cannot decide myself whether this tribe can be maintained or not. This would envolve a complete revision of all the genera of *Cantharidae,* a work which I hope to undertake later on.

The tribe *Omethini,* on the other hand, seems to be a very good division. Both genera *Omethes* Leconte and *Blatchleya* Knab are quite distinct from all the other *Cantharinae* by the form of the copulatory organ. This organ has a relatively free median lobe more similar to the *Malthinini.*

I also should like to point out that a second species has to be added to the genus *Omethes,* i.e. *Elianus rugiceps.* This genus and species were described by Lewis from Japan in 1895. Since Leconte described *Omethes* in 1861, *Elianus* falls into synonymy. I am particularly grateful to Hugh B. Leech of the California Academy of Sciences, San Francisco, who some time ago sent me specimens of *Omethes marginatus* which allow me to make this correction. The species from Japan is quite closely related to *marginatus,* the size is slightly smaller, head and prothorax of darker coloring, the latter without testaceous suture and the sides only occasionally and very narrowly testaceous.

Again to the courtesy of Mr. Leech I owe a few additional forms, which I am also including into the *Omethini.* One of the new genera, *Troglomethes* is of particular interest, because the head is transversally excavated. This formation is certainly the site of secretary pores of importance before or during copulation. The enlarged and excavated antennae of *Blatchleya gracilis* Blatchley no doubt also serve the same purpose. The excavated head, a characteristic found frequently in *Malachiidae* and other Coleoptera, is rare among the *Cantharidae.* To my knowledge so far only one other genus, *Pseudopodabrus* Pic, described from Tonkin, has an excavated head.

The different genera of *Omethini* males may be separated as follows:

1. Head simple, not transversally excavated 2
— Head transversally excavated .... **Troglomethes** nov. gen.
2. Antennae simple, no segments enlarged and excavated 3
— Two antennal segments enlarged and excavated .... **Blatchleya** Knab
3. Head strongly rugose, partly plicate. Basal angles of prothorax not completely rounded into base, all borders only slightly raised. Lateral lobes of copulatory organ very long, apparently not fused .... **Omethes** Lec.

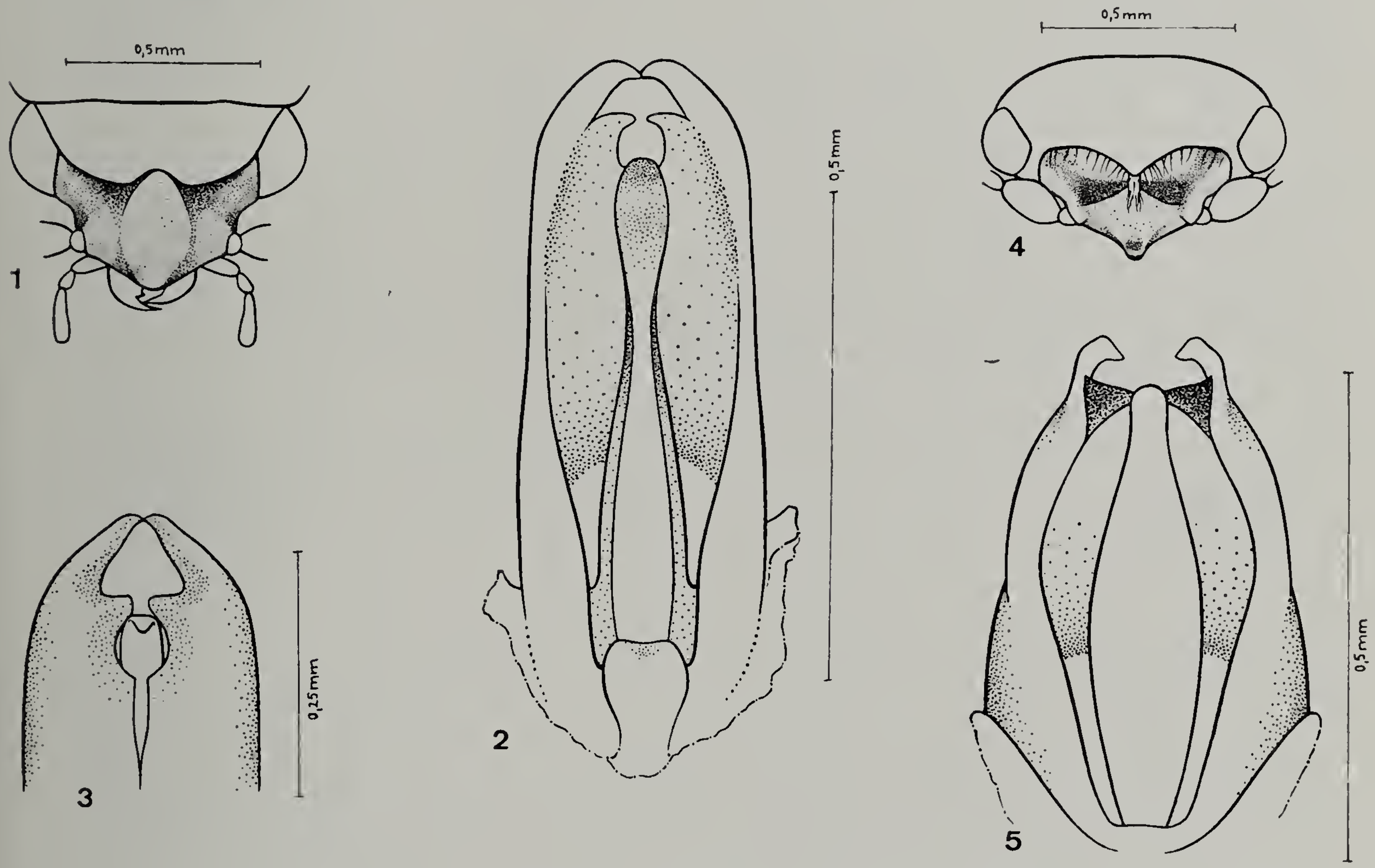
— Head not rugose, almost smooth or little punctate. Basal angles of prothorax completely rounded into base, all borders quite strongly raised all around but particularly at sides. Lateral lobes of copulatory organ completely fused, forming a normal basal piece as in other Cantharinae .... **Symphycmethes** nov. gen.

Troglomethes nov. gen.
type species: *T. leechi* n. sp.

Male. General appearance of *Blatchleya*, but distinct by the formation of the head which is transversally excavated and by the simple antennae.

Mandibulae toothed. Last segment of maxillary palpus narrow, elongate. Antennae 11-segmented, simple. Prothorax transverse, sides almost parallel or rounded, basal angles more or less rounded with sides and base; all borders raised all around, but particularly at sides. Claws simple with a small toothlike formation at base. Copulatory organ with a strongly sclerotized dorsal basal piece, the suture of fusion well apparent, median lobe lying ventrally free, uncovered as in the other *Omethini*.

This genus seems to be endemic to the West Coast of the United States. Two species are referred to it, one from Oregon and the other from California, both new.



Figs. 1, Head of *Troglomethes leechi* n. sp. male; 2. Copulatory organ, ventral view of same; 3. Copulatory organ, dorsal view of same; 4. Head of *Troglomethes oregonensis* n. sp. male; 5. Copulatory organ, ventral view of same.

Troglomethes leechi n. sp.

Male. Head, antennae, legs and prothorax yellow-testaceous, the latter with an ill defined brownish spot in the middle near the base, but without touching the base, scutellum, elytra and abdomen dark brown.

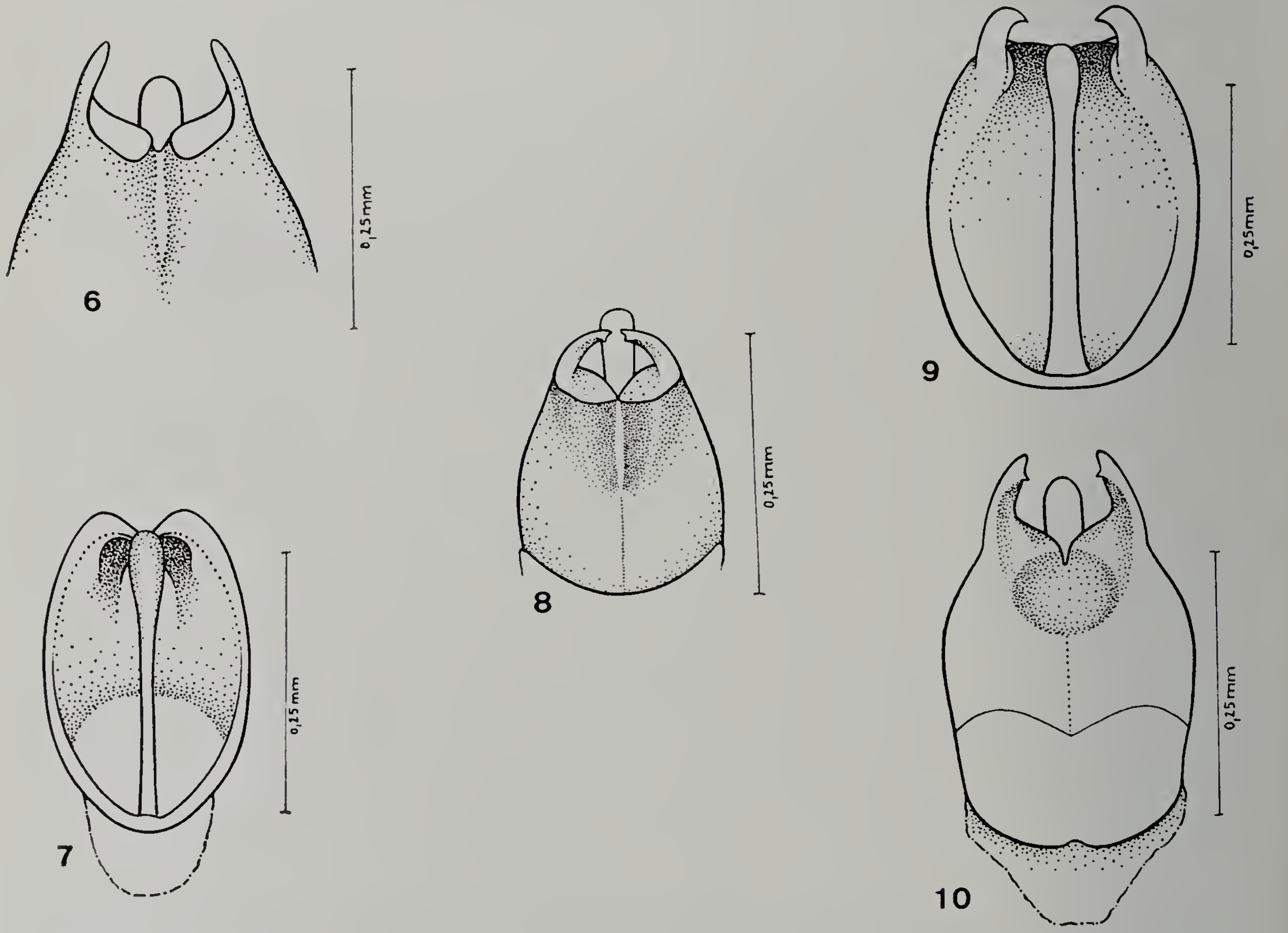
Head (Fig. 1) with the eyes narrower than the prothorax, frons, seen from above, with a strong bump, transversally excavated under the bump, excavation not reaching the eyes;

the excavation is covered in the middle by part of the antefrons which is extended backward to the bump, clypeus raised into a large nodule, surface above the excavation almost smooth with traces of extinct punctures. Antennae not too long and not too robust, all segments, except 11, slightly widened towards the tip, 2 half as long as 3, 3 to 8 of about the same size inter se. Prothorax broader than long, sides almost parallel, hind angles more strongly rounded than front angles, surface smooth, shining, pubescence almost invisible. Elytra elongate, rugose. Copulatory organ, ventral view Fig. 2, dorsal view Fig. 3 tip only.

Length: 3.5 mm.

Locality: USA, California, Glen Alpine, ex Fenyes collection, Holotype in the California Academy of Sciences, San Francisco.

I am placing provisionally 2 females of similar shape and coloration to this species. Both were found in California and bear the following labels: Yosemite Valley, 7.7.1921, leg. Van Dyke and Tallac, Eldorado Co., ex coll. F. E. Blaisdell, both in the California Academy of Sciences, San Francisco.



Figs. 6. Copulatory organ, dorsal view of same; 7. Copulatory organ, ventral view of *Symphyomethes blandulus* n. sp male; 8. Copulatory organ, dorsal view of same; 9. Copulatory organ, ventral view of *Symphyomethes californicus* n. sp. male; 10. Copulatory organ, dorsal view of same.

Glen Alpine is in El Dorado County, California, five miles south of the southwest corner of Lake Tahoe, altitude 6800 feet. Tallac was a resort area at the south end of Lake Tahoe, just west of what is now Camp Richardson, altitude 6240 feet.

Troglomethes oregonensis n. sp.

Male. Head, prothorax and scutellum dark brown, sides of the prothorax narrowly brownish-testaceous, antennae, elytra and legs brownish-testaceous.

Head (Fig. 4) with the eyes narrower than the prothorax, frons, seen from above, quite convex, transversally excavated between the eyes, excavation not quite reaching the eyes, frons extended in the middle into an obtuse prominence, under which a fine tuft of long hairs appears, which is placed on another prominence just under the one mentioned before; clypeus extended into a noselike projection with rounded tip. Antennae not reaching the hind coxae, quite robust, all segments, except 11, slightly widened towards the tip, 3 almost twice as long as 2, 3 to 10 of about the same size inter se, 11 the longest of all, about one half longer than 10. Prothorax much broader than long. sides rounded and narrowed towards base, basal angles completely rounded (with the sides and base), surface smooth, shining, pubescence almost invisible. Elytra elongate, in the middle, puncture disappearing towards apex, here rugose. Copulatoray organ, ventral view Fig. 5, dorsal view Fig. 6.

Length: 4 mm.

Locality: USA, Oregon, Cannon Beach, 12.6.1927, leg. E. C. Van Dyke. Holotype in the California Academy of Sciences, San Francisco.

Somewhat larger in size than *T. leechi,* to be distinguished easily by the differently excavated head, see figures.

Symphyomethes nov. gen.
type species: *S. blandulus* n. sp.

Male. General appearance of *Troglomethes,* but distinct by the simple, unexcavated head. Differs from *Blatchleya* by the simple antennae and the quite strongly raised borders of the prothorax.

Mandibulae toothed. Last segment of maxillary palpus narrow, elongate. Antennae 11-segmented, simple. Prothorax transverse, sides strongly rounded, basal angles completely rounded with the sides and base, all borders quite strongly raised all around but particularly at sides. Claws simple with a small toothlike formation at base. Copulatory organ with a strongly sclerotized dorsal basal piece, the suture of fusion quite well apparent, median lobe lying ventrally free, uncovered as in the other *Omethini.*

Two species are referred to this genus, both from California and both new.

Symphyomethes blandulus n. sp.

Male. Brown, head blackish, mouthparts, antennae, most of the femora, tip and base of tibiae and tarsi yellow-testaceous.

Head with the eyes narrower than the prothorax, vertex slightly convex, surface smooth, brilliant, a few extinguished punctures apparent, pubescence scarce. Antennae rather short and stout. all segments slightly widened towards the tip, 3 more strongly narrowed towards the base than the following, 3 longer than 2, 4 longer than 3, 5 slightly longer than 4, 5 to 8 of the same length, 9 and 10 a little shorter than 8, 11 the longest. Prothorax strongly transverse, almost twice as broad as long, sides completely rounded with the front and basal angles, surface almost smooth, a few strong punctures along the borders. Elytra widened towards the tip, covering the abdomen and the wings completely, surface extinctly rugose, hairs sparce and quite long. Copulatory organ Figs. 7 & 8.

Length: 2.5 mm.

Locality:: USA, California, Mendocino, 14.7.1954, leg. J. Helfer, from Redwood litter. Holotype in California Academy of Sciences, San Francisco. Mendocino is on the coast of Mendicino County; much of Mr. Helfer's collecting has been done 1.5 mi. north of town, at an altitude of 200 feet.

Symphyomethes californicus n. sp.

Male. Brown, prothorax testaceous, with the borders becoming gradually yellower all around.

Head with the eyes narrower than the prothorax, vertex slightly convex, two shallow depressions between antennal bases, surface quite strongly punctate, hairs very short, not abundant, much shorter than on prothorax. Antennae reaching to about middle of elytra, almost all segments very slightly widened towards the tip, segment 2 shorter than 3, 4 longer than 3, 4 to 8 of about the same length, 9 & 10 shorter than 8, 11 longer than 8. Prothorax strongly transverse, not quite twice as broad than long, sides completely rounded with the front and basal angles, surface almost smooth, a few somewhat obsolete punctures along the borders. Elytra widened towards the tip, covering the abdomen and the wings completely, surface rugose, hairs quite dense. Copulatory organs Figs. 9 & 10.

Length: 3.5 mm.

Locality: USA, California, Mokel Hill, April, leg. F. E. Blaisdell. Holotype in California Academy of Sciences, San Francisco.

Larger in size than *blandulus.* To be distinguished by the quite strongly punctate head and the testaceous prothorax with the yellow borders. In *blandulus* the head is smooth, unpunctured and the prothorax is of the same colour than the elyra. Mokelumne Hill is in Calaveras County, California, nine miles north of San Andreas, and at an altitude of 1475 feet. Dr. Blaisdell practiced medicine there for many years.

3.0009. On some Cantharidae (Coleoptera) of the United States. W. Wittmer.

ABSTRACT—The tribe Omethini of the family Cantharidae is revised and two new genera, *Trogomethes* and *Symphyomethes,* are added to the existing genera, *Blathleya* and *Omethus.* For each of the new genera two new species are described.—N. M. D.

DESCRIPTORS: Coleoptera; Cantharidae; Trogomethes; Symphyomethes; Blatchleya; Omethes; new genera; keys; new species; Pacific States.

3.0011 Two New Species of *Corticeus* From Mexico and Honduras (Coleoptera: Tenebrionidae)

BY CHARLES A. TRIPLEHORN[1] AND JOHN C. MOSER[2]

The genus *Corticeus* Piller and Mitterpacher is represented on every continent except Antarctica. Blackwelder (1945, p. 533) lists 10 species from Central and South America and Arnett (1963, p. 685) lists 13 from the United States. Most occur with bark beetles (Family Scolytidae), but their roles are poorly understood. Some authors have called them bark beetle predators, while others have regarded them as fungivorous, scavengers, or saprophagous. The literature on feeding habits has been well summarized by Struble (1930), Chamberlin (1939), and Parker (1969). Parker's extensive studies showed that *C. substriatus* (LeConte) eats a variety of foods in the subcortical niche; he concluded that the species is omnivorous.

The senior author has been accumulating specimens of *Corticeus* for a number of years, hoping ultimately to prepare a revision of the New World species or at least of the North American components of the genus. Most long series of these beetles have come from individuals conducting bark beetle studies. Two such investigators, J. F. Coyne and R. C. Wilkinson, collecting subcortical associates of *Dendroctonus frontalis* Zimm. in outbreak areas in Honduras, found large numbers of two species of *Corticeus*. A third worker, W. E. Rose, found one species common with *D. frontalis* infestations in Mexico.

Although it is premature to undertake a complete generic revision at this time, scientific names are needed for several pending manuscripts. These two very distinctive species are clearly different from any of the seven treated by Champion (1886, pp. 171-173 and 1913, p. 162) and hence should not add to the confusion in this poorly understood genus.

Both male and female genitalia of the two species were studied and, on the basis of limited dissections of other species, these structures were found to be nondiagnostic in distinguishing between species.

The senior author has prepared the descriptions and is to be cited as the author of the two species described below; the junior author took the photographs and is responsible for the ecological data.

Corticeus coynei Triplehorn, NEW SPECIES

Holotype, sex undetermined: elongate, slender, subcylindrical, light reddish-brown, glabrous, shining. Head uniformly coarsely and densely punctured; antennae reddish-brown with fuscous spots on apico-medial portions both dorsally and ventrally of segments 3 to 10; apical segment lighter; eyes coarsely faceted, separated dorsally by less than twice the observed dorsal diameter of one eye (figure 1) and ventrally by less than the observed ventral diameter of one eye (figure 2); ventral surface of head with only a few widely spaced fine punctures. Pronotum slightly broader than long, convex, lateral margins feebly arcuate, apical margin truncate, angles obtuse, not produced; basal margin arcuate, angles obtuse, slightly reflexed;

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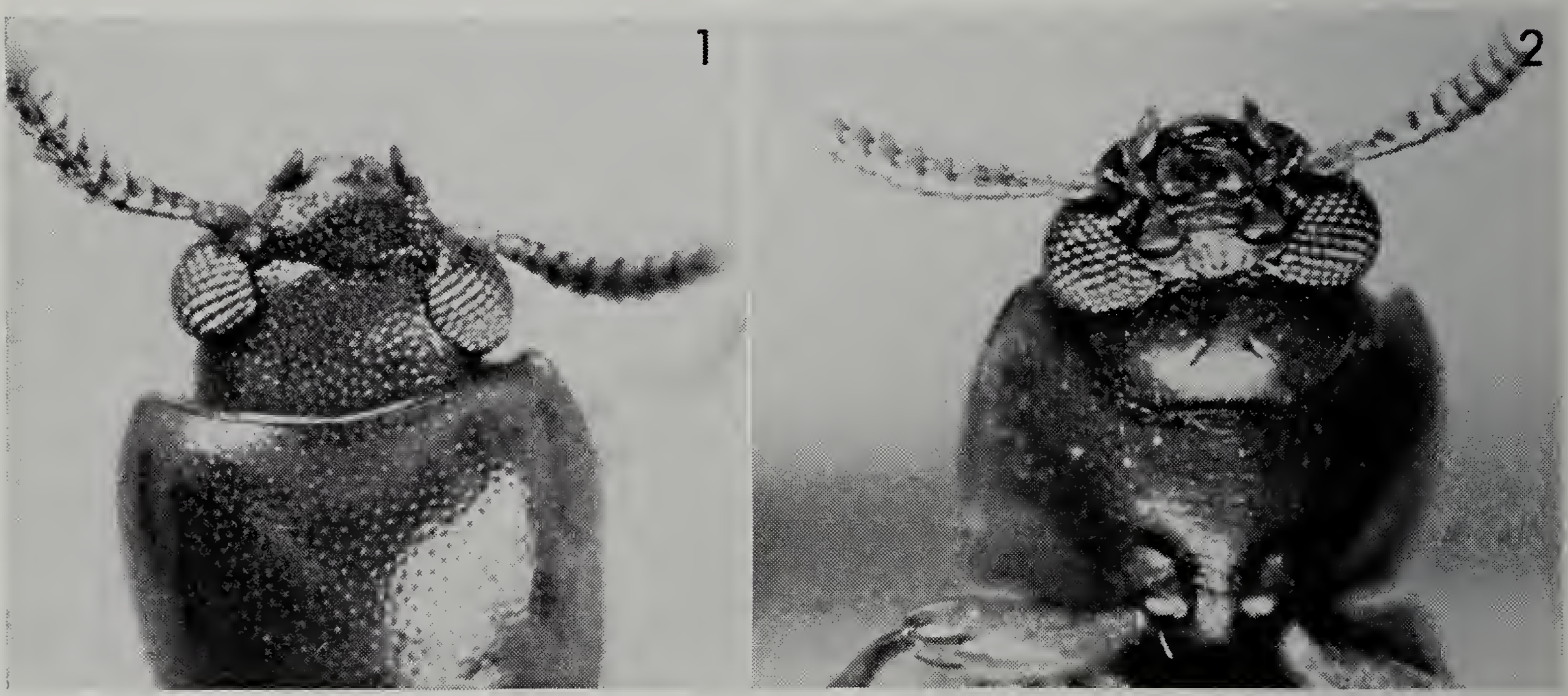
[2] Principal Entomologist, Forest Insect Research Project, Southern Forest Experiment Station, USDA Forest Service, Pineville, La.

entire perimeter finely beaded; surface moderately coarsely and densely punctured. Elytra slightly wider than pronotum, coarsely, densely, and confusedly punctured; pygidium with punctures becoming increasingly coarse from base to apex. Ventral surface lighter than dorsum with legs still lighter; flanks of prothorax coarsely and densely punctured; prosternum strongly alutaceous with fine, dense but very shallow punctures; prosternal process shallowly grooved and finely margined between procoxae, its apex deflexed and broader behind; mesosternum and metasternum and basal four abdominal sterna finely and sparsely punctured, dull and alutaceous; terminal abdominal sternum coarsely and densely punctured. Length: 3.4 mm; width: 1.1 mm.

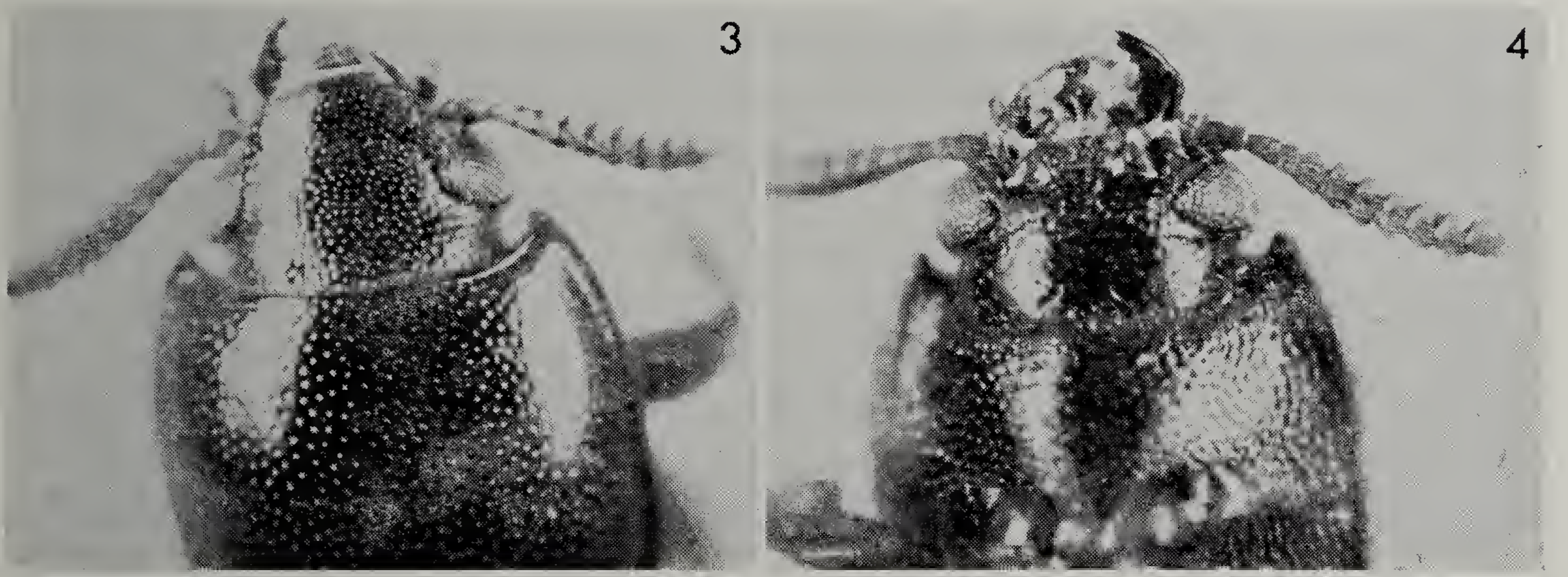


Figures 1-2. *Corticeus coynei* n. sp. Dorsal and ventral aspects of head. Eyes are large and narrowly separated. Pronotal angles are rounded.

Types: Holotype and 75 paratypes from Cedros, Honduras, February 1, 1965, J. F. Coyne, associated with *D. frontalis* and *Ips* spp. from *Pinus oocarpa;* 4 paratypes from Picacho, F. S., F. M., Honduras, Jan. 26, 1965, E. W. Clark, 2 from *Pinus oocarpa* and 2 from *Pinus pseudostrobus.* Holotype and paratypes in National Museum of Natural History; paratypes in Southern Forest Experiment Station, Pineville, La., Ohio State University Collection of Insects and Spiders, and British Museum (Natural History). The senior author has seen one additional specimen taken in 1966 in company with four specimens of *C. rosei* at Tegucigalpa, Honduras, from boring dust of *D. frontalis* ex. *P. oocarpa.*

Remarks: This species is named for the collector of the type series, J. F. Coyne, USDA Forest Service, Gulfport, Miss. It differs from *C. sordidus* Champion (1913, p. 162) in having the pronotum slightly broader than long and in not having the elytral punctures in rows. We have not seen *sordidus,* which is known only from a single specimen taken near Guatemala City. From the measurements given (length: 3¾ mm; width: ⅞ mm) it is a much more slender species than *coynei.* Other characters mentioned in the description of *sordidus* but not found in *coynei* are a deep transverse frontal groove, alutaceous elytral surface, and a constriction immediately before the hind angles of the pronotum. C. M. F. von Hayek compared paratypes of *coynei* with the unique type of *sordidus* and reports (personnal communication) that they are not conspecific.

There is very little variation in the type series and no evident sexual dimorphism. Range in size of type series: length: 3.0 to 3.7 mm; width: 1.1 to 1.3 mm.



Figures 3-4. *Corticeus rosei* n. sp. Dorsal and ventral aspects of head. Eyes are small and widely separated. Apical pronotal angles are acutely prominent.

Corticeus rosei **Triplehorn, NEW SPECIES**

Holotype, sex undetermined: elongate, slender, subcylindrical; pronotum, base of head, and scutellum black, anterior portions of head and elytra light reddish-brown, glabrous, shining. Head coarsely and densely punctured; antennae uniformly light reddish-brown; eyes small, finely faceted, separated dorsally by almost 2½ times the observed dorsal diameter of one eye (Figure 3) and ventrally by twice the observed ventral diameter of one eye (Figure 4); ventral surface of head black, coarsely and densely punctured. Pronotum slightly broader than long, convex, lateral margins parallel medially, arcuate basally and apically; apical margin broadly emarginate with apical angles strongly produced; basal margin arcuate, angles obtuse; entire perimeter finely beaded, somewhat flattened and reflexed along lateral margins, surface moderately coarsely and densely punctured. Elytra as wide as pronotum, substriate on disc, confusedly punctured laterally, punctures all subequal in size; pygidium coarsely and densely punctured. Ventral surface black, legs and mouthparts light reddish-brown; flanks of prothorax rugosely punctured, somewhat strigose; prosternum finely and densely punctured, transversely strigose; prosternal process shallowly grooved and finely margined between procoxae, its apex deflexed and broader behind; mesosternum and metasternum and abdominal sterna densely punctured with punctures becoming increasingly larger on lateral portions of sclerites; terminal abdominal sternum flattened medially. Length: 3.8 mm; width: 1.4 mm.

Types: Holotype and 30 paratypes from Puebla, Mexico, August to December, 1964, W. E. Rose, associated with *D. frontalis* and *Ips* spp.; 13 paratypes from 4 miles west of Rio Frio, (Mexico) Mexico, July 9, 1959, B. and B. Valentine, 10,500 feet, on *Pinus;* 2 paratypes from Amecameca, Mexico, March 17, 1954, R. L. Furniss, *Pinus hartwegii;* 1 paratype from Tlexcala (probably Tlaxcala), Mexico, March 13, 1954, R. L. Furniss and J. P. Perry, *Pinus rudis.* In addition to the type series the senior author has seen four specimens from Cedros, Honduras (included in the same vial with the type series of *C. coynei* (see above), four from Tegucigalpa, Honduras, 1966, from boring dust of *D.*

frontalis ex *P. oocarpa,* 2 specimens from Picacho, F. S., F. M., Honduras, Jan. 26, 1965, E. W. Clark, *Pinus oocarpa,* 1 from Valle de Angeles, Honduras, Feb. 12, 1965, E. W. Clark, *Pinus pseudostrobus.* Holotype and paratypes in National Museum of Natural History; paratypes in Southern Forest Experiment Station, USDA Forest Service, Pineville, La., Ohio State University Collection of Insects and Spiders, and British Museum (Natural History).

Remarks: This species is named for the collector of the type series, W. E. Rose. The coloration—consisting of a black ventral surface, black head, thorax, and scutellum, and reddish-brown elytra—is apparently unique and is quite constant in the series available. In size, body conformation and pronotal shape it is similar to the North American *C. parallelus* (Melsheimer). No external characters for separating the sexes were found.

This species appears to be dimorphic and the dimorphism is definitely not sexual. The one form (as in the holotype) has much more prominent apical pronotal angles, more broadly expanded lateral pronotal margins, and the head and pronotum are smooth and shining between the punctures. In the second form the head and pronotum are distinctly alutaceous, and the lateral pronotal margins are narrow with apical angles acute, but not conspicuously prolonged. These two forms are quite distinct and readily separable, and there is a possibility that two similar sympatric species are involved, but existing biological information more strongly suggests dimorphism. Range in size of type series: Length: 3.0 to 3.8 mm; width: 1.2 to 1.4 mm.

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DESCRIPTORS: Coleoptera; Tenebrionidae; *Corticeus;* new species; Honduras and Mexico.

3.0011. Two new species of *Corticeus* from Mexico and Honduras (Coleoptera: Tenebrionidae)

ABSTRACT—Two new species of *Corticeus* from Mexico and Honduras *C. coynei* and *C. rosei* Triplehorn are described. These were collected as subcortical associates of *Dendroctonus frontalis* Zimm., the southern pine beetle.

3.0008 Causal and Pitfall Trap Collections of Ground Beetles from Three Locations in the Ottawa District[1], Ontario

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During 1969, about 6,900 specimens of ground beetles were collected from pitfall traps at two sites in eastern Ontario, the Central Experimental Farm, Ottawa, and Richmond. Specimens were taken weekly from mid-July to mid-October from cultivated, unsprayed plots of cabbage used for studies by D. G. Harcourt on the population dynamics of the imported cabbageworm, *Pieris rapae* (L.). Other abundant prey were the diamondback moth, *Plutella maculipennis* (Curt.), and the cabbage maggot, *Hylemya brassicae* (Bouché). The texture of the soil in the plots ranged from loam to sandy loam.

Previously, the author had made a casual collection from an old meadow at Beechgrove, near Quyon in western Quebec. During 1966 and 1967, about 300 specimens were collected at random from pitfall traps and by digging in the surface layer of soil and sod. The site, in an area of sandy loam, was characterized by a patchy distribution of vegetation, varying from sparse to abundant. The principal flora were: timothy, *Phleum pratense* L.; black-eyed susan, *Rudbeckia serotina* Nutt.; goosefoot, *Chenopodium* sp., ox-eye daisy, *Chrysanthemum leucanthemum* L.; and goldenrod, *Solidago* sp. In addition, there were a number of tree and shrub seedlings.

Table 1 lists the 37 species of carabids collected at the three locations, with a record of their abundance. This gives an interesting comparison of species found in a permanent meadow and those found under row crop production. Except for *Harpalus pennsylvanicus* De. G., which was common everywhere, the complex of species at Beechgrove was quite different from that at Ottawa and Richmond.

Representative specimens are contained in the Canadian National Collection. Mr. R. de Ruette of this Institute confirmed or identified most of the species. Mr. Henri Goulet, now at the University of Alberta, Edmonton, identified many of the specimens from Beechgrove. Dr. George Ball of the latter institution identified the specimens of *Harpalus opacipennis* Hald.

LITERATURE CITED

HICKS, S. D. 1965. The northern limits of several species of Coleoptera with special reference to their occurrence in the Ottawa District. Coleopt. Bull. 19: 37-42.

DESCRIPTORS: Coleoptera; Carabidae; collecting data; Ottawa, Ontario, Canada.

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[1] The area embraced by a circle of thirty-mile radius centered at the Parliament Buildings, Ottawa (See Hicks, 1965).

TABLE I

Carabids collected from three locations in the Ottawa District

Species	Beechgrove	Ottawa	Richmond
*Pterostichus melanarius Ill.	0	very abundant	very abundant
Pterostichus lucublandus Say	0	2	13
Pterostichus chalcites Say	0	2	1
Harpalus pennsylvanicus DeG.	common	common	common
*Harpalus affinis Schrk.	1	common	common
Harpalus erraticus Say	common	3	8
Harpalus faunus Say	1	1	15
Harpalus funerarius Csiki	0	4	6
Harpalus pleuriticus Kby.	1	0	0
Harpalus herbivagus Say	4	1	5
Harpalus longicollis Lec.	0	0	2
Harpalus indigens Csy.	1	1	3
Harpalus opacipennis Hald.	common	1	1
Harpalellus basilaris Kby.	0	0	1
Amara obesa Say	common	0	1
*Amara apricaria Payk.	0	1	2
Amara avida Say	0	2	9
Amara carinata Lec.	0	9	5
*Amara aenea DeG.	1	1	1
Amara rubrica Hald.	common	0	0
Amara musculis Say	3	0	0
*Amara familiaris Duft.	2	0	0
Amara cupreolata Putz.	2	0	0
Agonum placidum Say	0	common	common
Agonum cupripenne Say	0	0	1
Stenolophus comma Fab.	0	common	common
Chlaenius tomentosus Say	common	0	1
Chlaenius sericeus Forst.	0	0	1
Dyschirius globulosus Say	1	0	0
Calosoma calidum Fab.	5	0	0
Anisodactylus rusticus Say	common	0	0
Anisodactylus sanctaecrucis Fab.	0	6	common
Anisodactylus nigrita Dej.	0	0	1
Calathus gregarius Say.	2	0	0
Calathus opaculus Lec.	4	0	0
Cymindis pilosa Say	common	0	0
Trichocellus cognatus Gyll.	0	0	1

*European introductions

3.0010 A New Species of *Metamasius* from Panama (Curculionidae, Rhynchophorinae)

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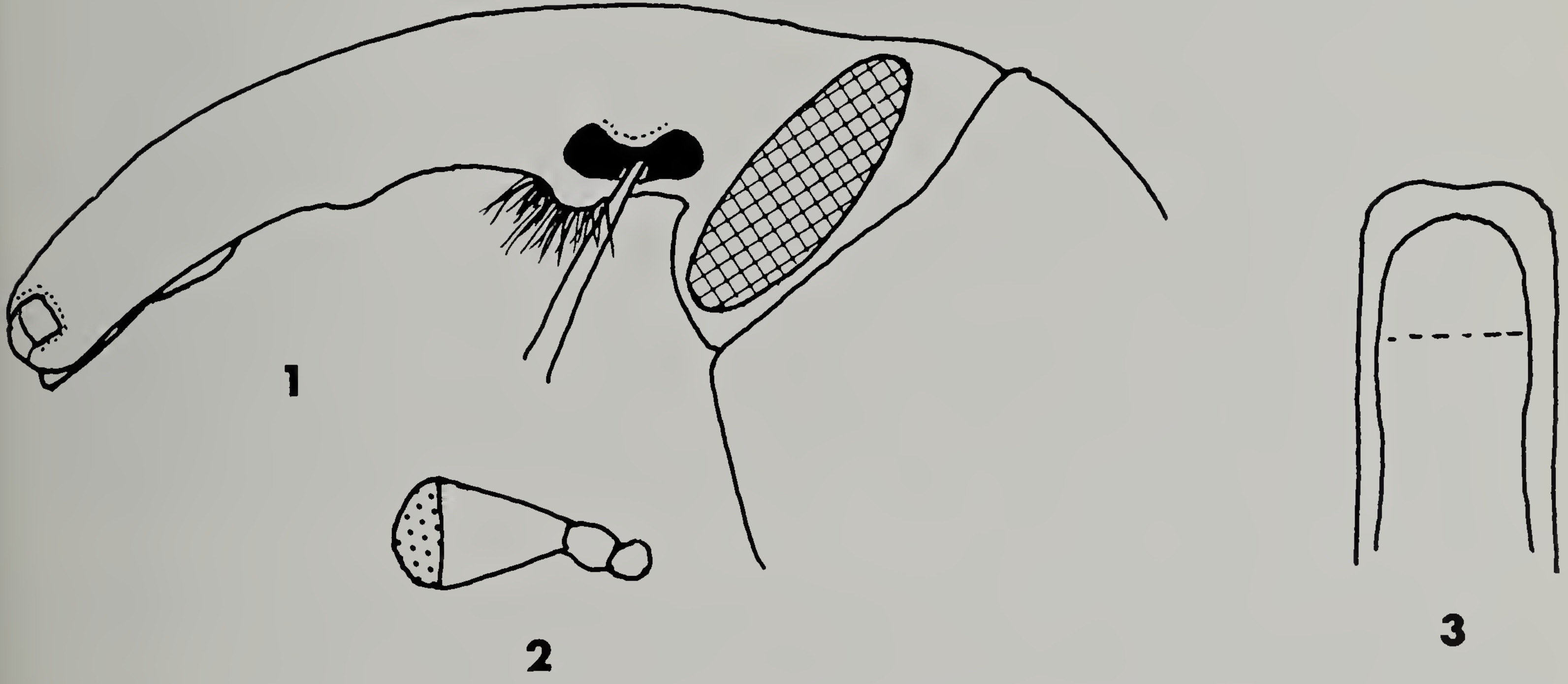
The species described below comes from the collection of Dr. Carlos Bordon Azzali of Caracas, Venezuela. Although there is one specimen only, a male, the species presents a combination of characters which distinguish it at once from other males of this large genus (104 species) of New World weevils. In the revision of the genus (Vaurie, 1966, 1967), three species were recorded from females only. Two of these (*monilis* and *personatus* Vaurie) belong in a different group as they have embossed orange or reddish spots on the elytra and no lateral line on the aedeagus. The other female without a matching male is the unique type of *semirubripes* Hustache which differs as noted in the key below.

METAMASIUS CRINITUS, n. sp.

Figs. 1-3

Type, male, Cerro Campana, Panama, October 8, 1967, R. L. Dressler, collector, in the collection of Dr. Carlos Bordon A., Caracas.

Diagnosis: Differing from all species by having under the beak a distinct tuft of long, dense, coarse, yellow hairs emerging from between the two large basal teeth (Fig. 1) Otherwise resembling *sierrakowskyi* Gyllenhal and allies in the stout body, stout, cylindrical beak, U-shaped scutellum, and strongly sinuate base of the pronotum, but differing from them by having the femora and episternal pieces punctate, not impunctate, and in the absence of long, male tibial hairs.



Figs. 1-3. *Metamasius crinitus*. 1. Head and beak, showing under side of beak with apical sinuation, middle angle, and basal tooth with hairs. 2. Antennal club. 3. Apical part of aedeagus.

Description of Type, Male: Black, but beak and tibiae red with black apices; some femora red toward base. Length, excluding beak, 15 mm. Beak arcuate, cylindrical, almost as stout as front femur, finely, densely punctate; in profile view lower edge at base toothed and coarsely hairy, at middle feebly angulate, near apex bisinuate. Peduncle of postmentum feebly vertically bilamellate. Antennae inserted close to eye, club with apical spongy part about one-third of whole. Pronotum distinctly longer than wide, punctate on sides and apex and on each side of impunctate median line, impunctate areas forming feebly elevated "M;" base strongly margined, at middle strongly sinuate. Elytra about one-third longer than pronotum, intervals wide, flat, virtually impunctate, at base straight; striae impressed, punctures smaller than those at base of pronotum and separated by from two to four times their diameter. Scutellum U-shaped, feebly concave in front. Pygidium only slightly narrowing to truncate apex.

Prosternum not hairy, slightly swollen in front of each coxa; venter strongly punctate except on virtually impunctate mesosternum; distance between front coxae about one-fourth of diameter of coxa, between middle coxae about equal to diameter; last segment of abdomen without hairs; femora punctate; tibiae straight; third segment of front tarsus as wide as antennal club, of hind tarsus slightly narrower, of front and middle tarsi slightly asymmetrical; third segment of all tarsi ventrally with hairy pads except in V-shaped basal area which is glabrous. Aedeagus (Fig. 3) apically feebly emarginate.

Remarks: *M. crinitus* belongs in Species Group I of *Metamasius* because of the lateral line on the aedeagus dividing the dorsal and ventral portions, but it resembles the majority of species of Species Group III by having the beak at the apex in dorsal view wider, not narrower, than the space between the front coxae. The six species of the *sierrakowski* subgroup of Species Group I, however, also have a wide beak combined with a lateral line on the aedeagus, and therefore *crinitus* may as well be associated with this subgroup, even though it does not agree with all the attributes of the subgroup given by Vaurie (1966, p. 236). Males of two species of this subgroup (*sanguinipes* Hustache and *tibialis* Waterhouse) agree with *crinitus* by having basal teeth and median angle under the beak, but they lack the cluster of hairs and the sinuations. In other species of the genus (males of *peruanus* Hustache and of *cinnamominus* Perty, and both sexes of *barbatulus* and *personatus* Vaurie) there are hairs under the beak, but they are arranged in a long fringe, not a basal tuft.

Another species to add to this subgroup is *semirubripes* Hustache (unique female described from Chanchamayo, Peru) which, for lack of a male, appeared in Vaurie (1967, p. 258) as *Incertae Sedis*. It is so similar to *crinitus* that I am almost certain that the male, when recognized, will have the proper aedeagus characteristic of Species Group I.

In my key (Vaurie, 1966, p. 242) *crinitus* goes to couplet 47. With the elimination of the scutellum in this couplet, *crinitus* would then proceed to 49 which would also need a slight change and which should then read:

49(47). Base of beak coarsely, confluently punctate and with deep median impressed line -- **sulcirostris** (in part)

Base of beak finely, if at all, punctate, and median impression deep or not 49a

49a(49). Scutellum elongate-triangular 50

Scutellum broadly U-shaped, slightly concave in front 49b

49b(49a). Dorsum black, surface smooth; elytral intervals at base flat; beak at base under antennal scrobes toothed and hairy; Panama; male .... **crinitus**, n. sp.

Dorsum brown, surface uneven; elytra with fourth interval and its striae at base depressed; beak ventrally neither toothed or hairy; Peru; female .... **semirubripes**

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DESCRIPTORS: Coleoptera; Curculionidae; Metamasius; new species; Panama.

BOOK REVIEW

SELANDER, R. B. AND J. M. MATHIEU. 1969. Ecology, Behavior, and Adult Anatomy of the Albida Group of the Genus *Epicauta* (Coleoptera, Meloidae). Illinois Biological Monographs, No. 41, 168 pp., 60 figs. University of Illinois Press, Urbana, Ill. Price $5.95.

In this volume is presented a systematic study of eight species of blister beetles. Specimens were studied in detail in both the laboratory and in the field. Several preliminary chapters are devoted to method and to the composition and systematic position of the group. This is followed by a long chapter covering bionomics. One of the major elements of this chapter is devoted to the food choices of the various species. Data are also presented on seasonal distributions of the species, longevity, cleaning habits, and all aspects of behavior other than sexual. The next chapter is entirely concerned with sexual activity, this being described in great detail. Most of the 60 figures and photos depict courting and mating activities. This chapter is followed by one on adult anatomy and this in turn by one on the interrelationships among the various species. The last chapter contains a key to the adults with a listing of the synonomy and locality records for each species.

This writer enjoyed this book. He feels that it should serve as a model for the study of insect ecology and ethology. The writer sees such studies as making up one of the major aspects of entomological research of the future. Only through the results of work like this will we ever understand the hows, wheres, and whys of insect life. This reviewer feels that this work is very well done. It is highly recommended for a position in the library of the entomologist where it can be consulted as a most useful model or design for research in entomology.—N. M. D.

3.0013 A new record of CHLAENIUS (AGOSTENUS) PURPURICOLLIS (Randall) (Carabidae) from New Mexico.

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During a collecting trip in the Southwest in the summer of 1968, I had occasion to cross over the Sacramento Mountains in my way from Carlsbad to Alamogordo (New Mexico). There, on a rocky slope with grass covering near Cloudcroft at about 8500 feet, specimens and species of Carabidae were numerous. Among many abundant species, some less numerous can be cited such as DIPLOCHILA OBTUSA (LeConte), DICAELUS LAEVIPENNIS (LeConte), BADISTER FERRUGINEUS (Dejean) sbsp. ANTHRACINUS (LeConte), EVARTHRUS TORVUS TORVUS (LeConte), or SYNUCHUS DUBIUS (LeConte). But the most interesting specimen was a female of AGOSTENUS PURPURICOLLIS (Randall). I confirmed the identity of this species through the kindness of Mr. J. Nègre who possesses a few specimens, all from the Northeast (New York state). Comparison was also made with one specimen in the National Museum of Natural History in Paris, in the collection Oberthür, ex collection Chaudoir, but with no precise locality. According to Bell (1960), this species is known only from the Northeast and the northern plains. This record from the Sacramento Mountains extends its geographical range southwestwards almost to the Mexican border.

The specimen from the Sacramento Mountains cannot be separated from the specimens from the northeast by coloration, punctuation, size, and general habitus. The only distinction, refering to Bell's work, would be the covering of the left paramere, but on one specimen, no definite conclusion can be made, additional material from the area being needed in order to study this point. As I have not seen specimens from the northwestern plains belonging to sbsp. FROSTII (Carr), I cannot compare my specimen with it, however, according to the descriptions, it seems right to consider the specimen from the Sacramento Mountains as belonging to sbsp. PURPURICOLLIS (s. str.).

The presence of a species predominantly northern in the southern New Mexico mountains may be expected as the climate in the higher slope of the Sacramento Mountains is montane and the particular collecting area was surrounded by cold coniferous forest. Many species have such distributions far south along mountains and it is probable that more northern species will be discovered in the higher slopes of the Sacramento Mountains in the future.

LITERATURE CITED

BELL, R. T. 1960. Misc. Pub. Ent. Soc. America (1) p. 97-171 "Revision of the genus *Chlaenius* (Bonelli) in North America."

DESCRIPTORS: Coleoptera; Carabidae; *Chlaenius purpuricollis;* distribution; New Mexico.

3.0017 On Gender Concord in Binomina

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The International Rules of Zoological Nomenclature (Article 11.g.1) require that adjectival species-group names agree in gender with their genus-names. This is a requirement of all present codes of biological nomenclature since their inception. It is a small part of Latin grammar that is firmly imbedded in nomenclature, with hundreds of thousands of names conforming to it. Nowadays many biologists, especially in the United States, become systematists without the benefit of any exposure to Latin grammar. Anyone will admit that gender concord is a nuisance; natural languages are evolving away from it, the Romance languages have discarded the neuter, and English has done away with gender except in pronouns.

But with the tremendous heritage of gender-concordant names we already have, now may we simplify the system? Some believe that retention of the originally proposed form, regardless of the generic combination, is the solution. Another way would be to change the grammar we use from the 3-ending system of Latin to a single-ending system, as has been done in the evolution of many languages. But this would do a certain amount of violence to the million or so names already in use, some for two centuries.

Let us consider the names used in 2 recent works (Kistner, 1969; Butte, 1968a, b, c), as a small sample out of the many now available.

Kistner adds 3 new species to the genus *Schizelythron* Kemner, originally proposed with the sole species *javanicum* for a beetle with split elytra. The genus is correctly of neuter gender. The one adjectival name proposed by Kistner, *sarawakensis,* should therefore be *sarawakense.*

Butte uses the following binomina:

Chalepus bacchus (Newman) (*Hispa*)
**C. bellula* (Chapuis) (*Odontota*)
C. bicolor (Olivier) (*Hispe*)
C. hebalus Sanderson
C. walshii (Crotch) (*Odontota*)
Xenochalepus ater (Weise) (*Chalepus*)
**X. omogera* (Crotch) (*Odontota*)
**X. potomaca* n. sp.
X. robiniae n. sp.
**Odontota arizonicus* (Uhmann) (*Xenochalepus*)
O. dorsalis (Thunberg) (*Chalepus*)
**O. floridanus* n. sp.
O. horni Smith
**O. mundulus* (Sanderson) (*Xenochalepus*)
O. notata (Olivier) (*Hispa*)
O. scapularis (Olivier) (*Hispa*)

Those marked with an asterisk should have different endings, *-us* instead of *-a* and vice versa. The names are all in the form originally proposed, regardless of the genus in which they are now placed. Apparently because *C. bellula* and

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X. omogera were proposed in the feminine genus *Odontota* they remain feminine in masculine genera; and *O. arizonicus* and *O. mundulus,* proposed in the masculine genus *Xenochalepus,* remain masculine in the feminine genus *Odontota.* Why *Odontota floridanus* is proposed as a new species with a masculine name in a feminine genus, while *Xenochalepus potomaca* is given a feminine name in a masculine genus is hard to understand. If one wishes to use an adjectival name such as *floridanus,* the choice between its 3 gender forms *floridanus, floridana,* and *floridanum* must be made on the basis of the gender of the genus-name with which it is combined. Is it any easier to remember or to find the original form than to remember that *Chalepus* and *Xenochalepus* take the forms in *-us,* while *Odontota* takes those in *-a*? It is not hard to remember that names like *Chalepus* and *Xenochalepus* (as well as *Oxychalepus, Temnochalepus, Anisochalepus, Goyachalepus, Parachalepus, Macrochalepus,* and *Hemichalepus)* are masculine. If the correct form is to be considered as the one originally proposed, the only way to determine it is to consult a catalogue or, preferably, the original description. We cannot obviate the fact that Latin adjectives exist in either 1, 2, or 3 distinct forms according to a definite system. It seems to me that the choice is between rigidified chaos and complex order. If we are dissatisfied with the rules, shall we meanwhile follow them and eventually by orderly action change them, or shall we be militantly dissident and follow our own choice, regardless of how few others may find that choice any better than existing rules? It would also seem to me that when editors of technical journals require authors to conform to their conception of correct English, they should also require authors to conform to the more elementary rules of the grammar of nomenclature.

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.... 1968b. *Idem.* II. Genus Chalepus Thunberg (Coleoptera. Chrysomelidae). Jour. N. Y. Ent. Soc. 76:117-133.

.... 1968c. *Idem.* III. Genus Odontota Chevrolat (Coleoptera, Chrysomelidae). Coleopt. Bull. 22:101-124.

KISTNER, D. H. 1969. Revision of the termitophilous subfamily Trichopseniinae (Coleoptera, Staphylinidae). I. The genus Schizelythron Kemner. Ent. News 80:44-53.

DESCRIPTORS: Insecta; Coleoptera; nomenclature; agreement of generic and specific names.

3.0012 A Replacement Name For *Malacorhinus* tripunctata (Jacoby) Galerucinae: Chrysomelidae)

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In the process of working over the species of Chrysomelidae described and enumerated by Martin Jacoby in the Biologia Centrali-Americana (1880-1892), I came upon a species of Galerucinae described by Jacoby (1879) in a pre-Biologia work. This species was originally described as *Diabrotica tripunctata* in 1879. In 1887, in the Biologia, Jacoby placed this species in the genus *Malacorhinus* where it has remained to the present time. However, in 1801, Fabricius described a species as *Criocerus tripunctata* which was later transferred to *Diabrotica* by Chevrolat (1837). This Fabrician name is now considered as a junior synonym of *D. capitata* (F.), and forms an interesting nomenclatural problem of its own as shown by Lever (1930) and Barber (1947). Thus, when described, *D. tripunctata* Jacoby was a homonym of *D. tripunctata* (F.) and even though it was later transferred to another genus it still remains a homonym and must therefore be replaced. I therefore propose the name *Malacorhinus tilghmani* as the replacement name for *D. tripunctata* Jacoby.

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LEVER, R. J. A. W. 1930. Notes on nomenclature of some noetropical Chrysomelidae (Coleoptera) with descriptions of two new species. Ann. Mag. Nat. Hist., serv. 10, 6:668-671.

ABSTRACT—The name *Malacorhinus tilghmani* Mignot is proposed as a replacement name for *Diabrotica tripunctata* Jacoby a homonym of *Diabrotica tripunctata* (F.).

DESCRIPTORS: Coleoptera; Chrysomelidae; Galerucinae; Malacorhinus; Classification.

BOOK REVIEW

PINTO, JOHN D. AND RICHARD B. SELANDER. 1970. The Bionomics of Blister Beetles of the Genus *Meloe* and a Classification of the New World Species. Illinois Biological Monographs, No. 42, 222 pp., 198 figs. University of Illinois Press, Urbana, Ill., price $10.00.

Some thirty-five years ago when I first began to collect beetles, I sent to the late C. A. Frost of Framingham, Mass. several *Meloe* that I had carefully classified using Blatchley's Coleoptera of Indiana. Frost changed the names on my specimens and then went on in a letter to state that "Blatchley was off his trolley on *Meloe*". It seems that it has been this way ever since whenever I have tried to identify members of this genus to species.

At last, our doubts and confusions have been laid to rest. This new publication has as one of its major contributions a key to the 23 New World species of *Meloe* along with a description of each species and its known geographic distribution. In this monograph seven new species are described and five names are placed in synonomy.

In addition to the taxonomic section that makes up the last 130 pages of the work, an unusually good discussion of the bionomics of the genus appears in the remainder of the book. Included in this section is the economic importance of the genus, this having in it the damage done to cultivated plants, harm to honey bees, and the medical importance of the group. This is followed by a discussion of the known enemies of *Meloe* and this in turn by the geographic distribution of the genus. A long section on the adult stage including seasonal distribution and behaviors, both sexual and non-sexual then follows. The next part of the bionomics section is labelled ontogeny. In this the development of *Meloe* is followed from the egg stage to the sexually mature adult. Then this part is concluded with a discussion of the interspecific ecological relationships of the Illinois members of the genus.

The writer feels that this monograph is a first rate job, up to the senior author's usual high standard. Like its entomological predecessors in the series this volume belongs in the library of every entomologist.—N.M.D.

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CARABIDAE: Will exchange French beetles of families Scarabaeidae, Histeridae, Buprestidae, Chrysomelidae, Coccinellidae, Anthicidae, Tenebrionidae, and water beetles for U. S. Carabids. Jacques Negre, 9, Bd. De Lesseps, Versailles, France.

SCARABAEIDAE: Interested in obtaining specimens of the genus *Coenonycha* for research and in building up a collection of scarab genera from the U.S.A. Exchange. Mrs. Jean Davidson, Dept. of Entomology, Oregon State University, Corvallis, Ore. 97331.

BUPRESTIDAE: Will exchange specimens and determine *Chrysobothris* from southwestern U.S.A. Jerry Davidson, Dept. of Entomology, Oregon State University, Corvallis, Oregon 97331.

CARABIDAE, SCARABAEIDAE: Collect, exchange. William D. Harding, 4365 Midland, Drayton Plains, Mich. 48020.

SCARABAEIDAE: Limited number of *Pleocoma badia* available. Terry W. Taylor, 8529 Norwood Pl., Rosemead, CA 91770.

ELATERIDAE: Revising *Physorhinus,* wish to borrow pinned or alcohol material. D. Schaaf, Dept. of Entomology, Purdue University, Lafayette, Indiana 47907.

STAPHYLINIDAE: Currently beginning study of taxonomy and morphology of larvae and adults of the Staphylinid subfamily Leptotyphlinae. Would like to borrow specimens in this group from North America primarily, but would welcome material from Central or South America. J. F. Cornell, Ass't Prof. of Biology, Appalachian State University, Boone, N. Car. 28607.

TENEBRIONIDAE: Will exchange South American, Andean, and desert forms for any other groups of insects from Chili. Luis. D. Pena, G.P.O. Box 2974, Santiago, Chile.

CICINDELIDAE: Interested in obtaining specimens of Cicindela trifasciata peruviana from Peru and Ecuador. Will exchange for other Chilean species. Luis E. Pena, G.P.O. Box 2974, Santaigo, Chile.

SCARABAEIDAE, CERAMBYCIDAE, LUCANIDAE: Goliath beetles, 14 different aberrations; 200 other species of beetles; for sale. Russell Dunn, Box 468, Sedona, Arizona, 86336.

VIET NAM COLLECTION: Will exchange recently collected material from S.E. Asia for material from Southwestern U.S.A. Anyone wishing to determine material from this collection may keep the determined specimens. Bruce W. Miller, Dept. of Biological Sciences, Univ. of Nevada at Las Vegas, Las Vegas, Nevada, 89109.

COLYDIIDAE: Revising the family for America north of Mexico. Wish to borrow material; will exchange for other Coleoptera. Karl H. Stephan, 3038 E. Eastland, Tuscon, Ariz., 85716.

LIMNEBIIDAE: Revising the genus *Ochthebius* for North America. Desire material mounted or in alcohol. F. E. Wood, Dept. Ent., Univ. of Md., College Park, Md. 20742.

Compiling a check-list of the beetles of Clark Co., Nev. I would like to correspond with Coleopterists who have collected in southern Nevada. B. W. Miller, Dept. of Biol., Univ. of Nev. at Las Vegas, Las Vegas, Nev. 89109.

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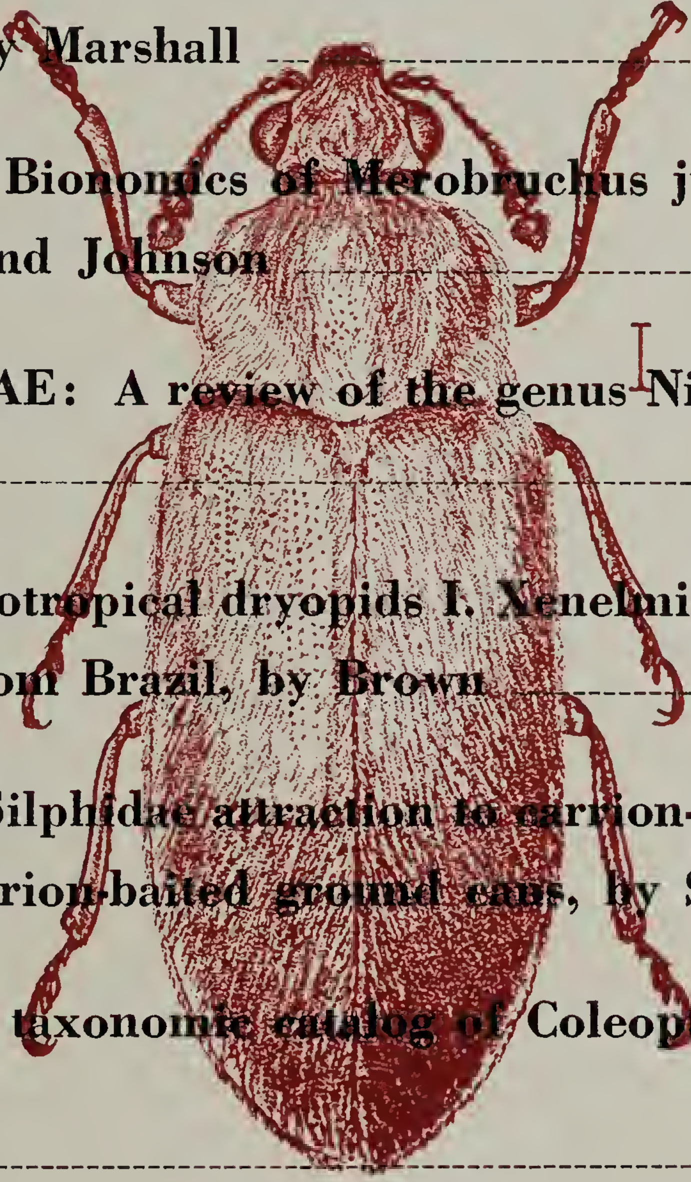

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DEPARTMENT of ENTOMOLOGY
Purdue University - Lafayette, Indiana

THE COLEOPTERISTS' BULLETIN

Founded 1947 by Ross H. Arnett, Jr.

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THE COLEOPTERISTS' BULLETIN

VOLUME 24 SEPTEMBER 1970 NUMBER 3

(3.0013)

Neotropical dryopoids I. *Xenelmis laura*, a new species from Brazil (Coleoptera, Elmidae)

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NORMAN, OKLAHOMA 73069

The Genus *Xenelmis* Hinton 1936 is represented by seven known species of minute beetles ranging from central Mexico to northern Argentina. In 1946, Hinton divided these into three species-groups: (1) the *granata* group, with a well-developed sublateral pronotal carina; (2) the *micros* group, lacking such a carina but with a submedian row of granules on the pronotal disc; and (3) the *bufo* group, lacking both of these features. The new species here described appears to be intermediate between the *micros* and *bufo* groups in that some individuals exhibit the submedian row of pronotal granules while others do not. Since this feature is the only character I find separating these specimens, I do not consider it of taxonomic significance in this species. Presumably the character is more constant in the species treated by Hinton. Initially, I assumed that my specimens represented two species.

The new species is named in honor of my wife, who has accompanied me on every riffle beetle expedition as a long-suffering car-sitter.

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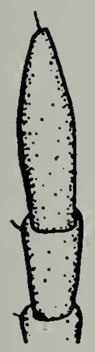

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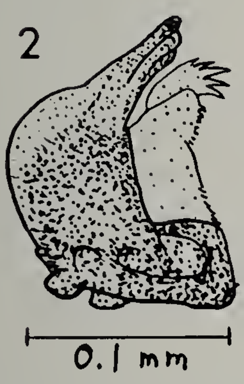

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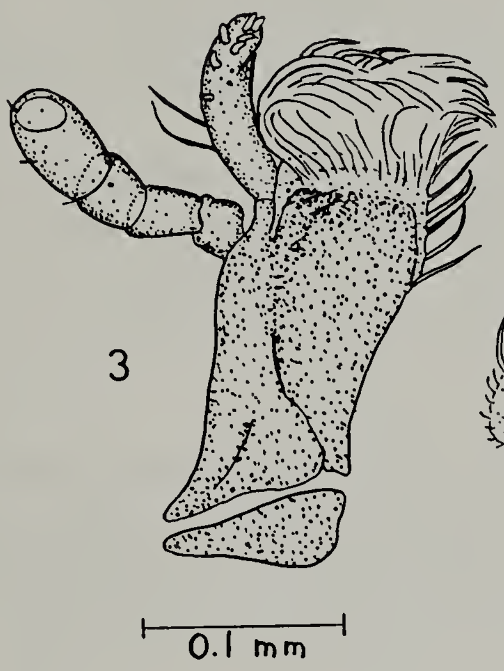

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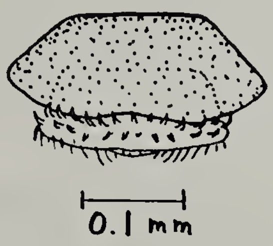

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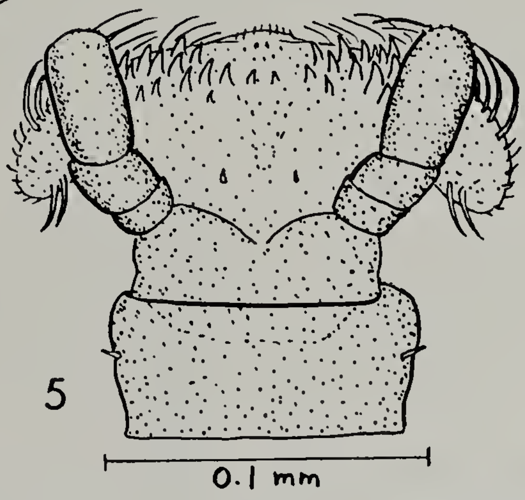


Fig. 1. *Xenelmis laura* sp. n. Apical and subapical segments of left antenna of male, dorsal aspect.

Fig. 2. *X. laura* sp. n. Mandible of male.

Fig. 3. *X. laura* sp. n. Maxilla of male. Basal segment of palp is globular and discrete.

Fig. 4. *X. laura* sp. n. Clypeus and labrum of male.

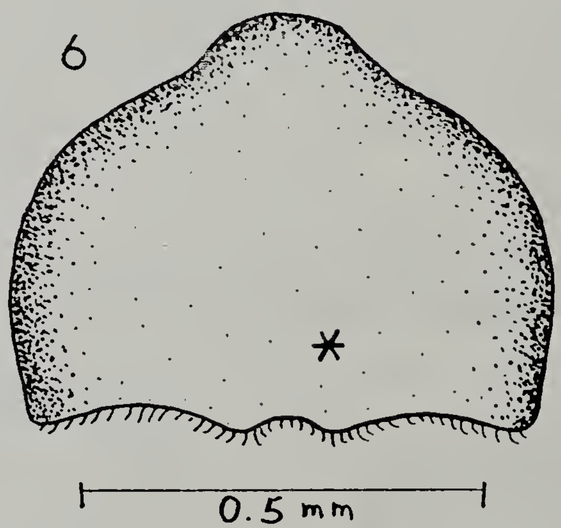
Fig. 5. *X. laura* sp. n. Labium of male, ventral aspect.

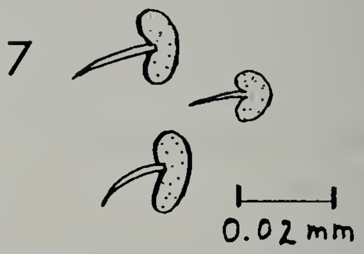
Xenelmis laura Brown, New Species

(Figs. 1-14)

Male: Length 1.3 mm; breadth 0.81 mm. Body broadly obovate and strongly convex; elytra especially convex near basal third. Cuticle feebly shining and reddish brown; pronotum with bronze case; tibiae and tarsi rufo-testaceous; maxillary and labial palps testaceous.

Head on each side with a low ridge extending forward from near middorsal line on vertex, curving gently outward, and terminating near base of antenna; ridges about 0.10 mm apart at base; between these ridges the vertex is shallowly depressed. Antenna about 0.43 mm long, the apical segment fusiform, with a terminal seta (Fig. 1). Mandible inflated near middle, abruptly tapering to the three subparallel, blunt apical teeth; prostheca membranous, spiny at apex (Fig. 2). Maxilla with stipes rather elongate; basal segment of palp globular; galea curved, elongate, with short, stout, blunt apical and subapical spines; lacinia short, broad, apex densely covered with rows of rather long, curved setae directly medially (Fig. 3). Clypeus apically emarginate; labrum retractile (?), apex broadly arcuate, with a row of marginal setae; upper setae (beneath clypeus) recurved (Fig. 4). Labium with both mentum and prementum transverse; ligula broadly expanded and rather densely clothed with spines and setae of distinctive shapes and sizes as shown, lateral margins (angles) recurved (Fig. 5).





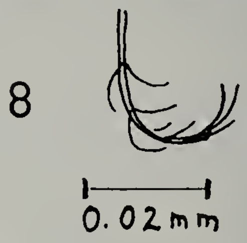


Fig. 6. X. *laura* sp. n. Pronotum of male, dorsal aspect.

Fig. 7. X. *laura* sp. n. Setiferous tubercles of pronotum at location indicated by asterisk in Fig 6.

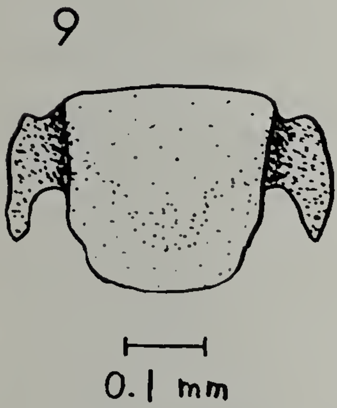
Fig. 8. X. *laura* sp. n. Plumose hair from posterior margin of pronotum just to the right of scutellar notch.

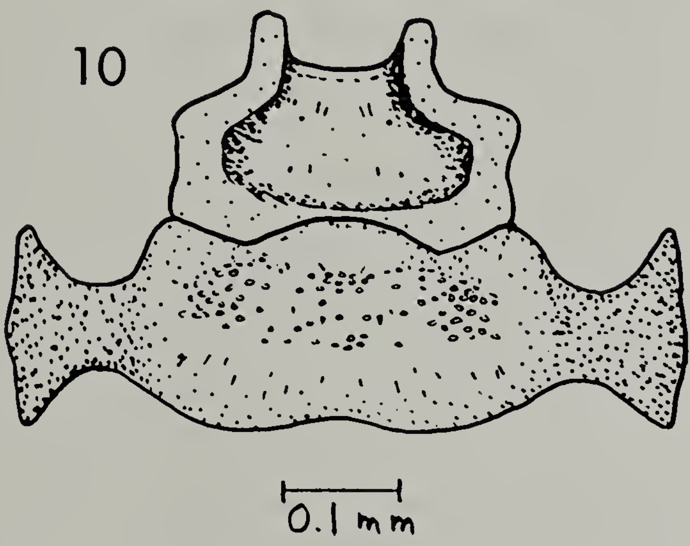
Pronotum (Fig. 6) 0.5 mm long, 0.63 mm wide at base, expanding to 0.68 mm at about basal one-third, then tapering roundly and bulging anteriorly to an arcuate apex; base trisinuate; disc rather evenly convex; surface sparsely covered with reniform setiferous tubercles (Fig. 7); at base in front of scutellum with a central region which lacks tubercles although setae are present. Basal margin bordered by a row of curved plumose hairs (Fig. 8).

Elytra fused at base; 0.80 mm long, 0.69 mm wide at base, increasing to 0.81 mm at widest point, which is between basal one third and one half. Lateral margins explanate, finely crenate to subserrate. Apices conjointly produced and rounded. In addition to the two sublateral tuberculate carinae on each elytron, there is an inconspicuous carina in the third strial interval extending from base to near middle and composed of 18-22 setiferous, oblong to reniform tubercles. These tubercles are distinctly smaller than those of the major (sublateral) carinae. Strial punctures shallow; strial intervals flat. Surface with sparse, inconspicuous setae. Hind wings absent. Scutellum transverse, ovoid, about 0.086 mm long and 0.10 mm wide, slightly notched at sides; surface flat, punctate.

Prosternum (Fig. 9) 0.27 mm long; prosternal process 0.15 mm long and 0.27 mm wide; carinate from mesial margin of procoxal cavity to anterior margin; with sparse, small, anteriorly-directed discal setae. Mesosternum (Fig. 10) narrowest at anterior margin, where its width is only half that at the center or at the posterior margin; groove for reception of prosternal process expanded posteriorly; posterior margin broadly and arcuately emarginate. Metasternum (Fig. 10) with rounded anterior margin fitting into emargination of mesosternum; disc with small granules or tubercles clustered chiefly in anterior half, setae sparse and chiefly in posterior half. Abdominal sternites with no appreciable granules, but sparsely covered with setae.

Fore tibia with an apical cluster of short, stout spines. Middle tibia with a median apical tuft of pale setae; hind tibia with an even more conspicuous apical tuft of slender, pale, distally-directly setae fully one-third as long as tibia (Fig. 11). First four segments of each tarsus on ventral surface with two rows of long, pale, erect hairs (Fig. 11).





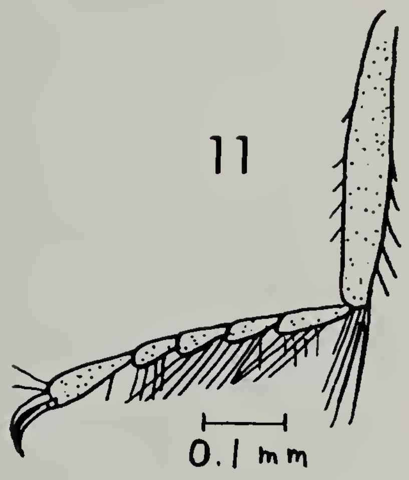


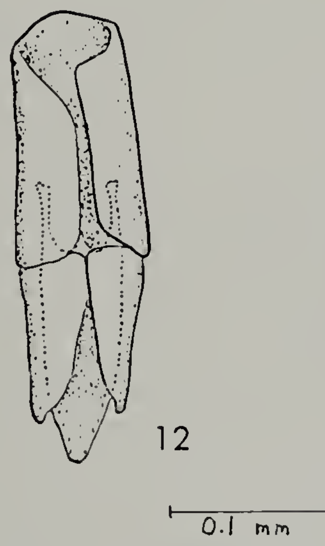
Fig. 9. X. *laura* sp. n. Prosternum of male, ventral aspect.

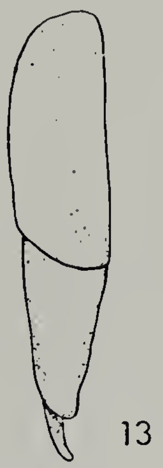
Fig. 10. X. *laura* sp. n. Mesosternum (above) and metasternum of male, ventral aspect.

Fig. 11. X. *laura* sp. n. Tibia and tarsus of male, right hind leg, ventral aspect

Genitalia with both penis (middle piece) and parameres relatively broad and blunt; basal piece longer than parameres or penis (Figs. 12, 13).

Female: Length 1.3 - 1.4 mm; breadth 0.75 - 0.80 mm. Externally similar to male except that apical tufts of setae on middle and hind tibiae and hairs of tarsi are much shorter and less noticeable, and tend to curl slightly. Genitalia relatively elongate and slender (Fig. 14).





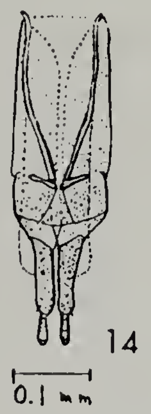


Fig. 12. X. *laura* sp. n. Male genitalia, dorsal aspect.

Fig. 13. X. *laura* sp. n. Male genitalia, lateral aspect from right side.

Fig. 14. X. *laura* sp. n. Female genitalia, dorsal aspect.

Type: Male in the University of Oklahoma Museum of Science and History (Stovall Museum), Norman, Oklahoma (dissected, mounted on slides XA 10, XA 11, and XA 12). BRAZIL: Pará—Rio Bananal near Agua Azul, June 9, 1968; elevation about 350 feet.

Specimens examined: Type male and five female paratypes with the same data.

Variations: In two of the five females, there is a submedian longitudinal row of fine tubercles or granules on each side of the pronotum. In the other three females and the male, the pronotal tubercles appear to be randomly distributed. One of the latter females is much darker than the rest, with rufo-piceous elytra and distinctly bronzed pronotum.

Comparative notes: This species seems closest to *X. teres* Hinton, which was described from Porto Velho, Matto Grosso, Brazil (Hinton, 1946). It differs from *X. teres* in lacking hind wings, in having smaller granules in the carina of the third strial interval, in having apical tufts of setae on the middle and hind tibiae and rows of hairs on the first four tarsal segments, in the presence of reniform setiferous tubercles on the pronotum, and in commonly lacking submedian longitudinal rows of granules on the pronotum. The structure of the male genitalia and the presence of erect hairs on the soles of the tarsus suggest a relationship to *X. audax* Hinton and *X. comis* Hinton. From these, *X. laura* sp. n. differs in having 18-22 granules rather than about 10 in the third strial interval, in having apical tufts of setae on the middle and hind tibiae, in the distribution of tarsal hairs, and in lacking hind wings (Hinton made no mention of the absence of hind wings in any species, and figured the wing of *X. bufo* in his 1940 paper).

Although Hinton created the Genus *Xenelmis* in 1936, his most complete treatment of the features of the genus is in his 1940 paper, which includes replicates of the figures from his original description. The following key to the species of *Xenelmis* is adapted from that published by Hinton in 1946.

Key to the Species of *Xenelmis*

1. Pronotum with a prominent sublateral carina or line of granules extending from base to about apical fourth. (Santa Catharina, Brazil) .... **X. granata** (Grouvelle, 1888).

Pronotum without a sublateral carina 2

2(1). Middle and hind tibiae with apical tufts of setae (Fig. 11); segments 1-4 of all tarsi bearing two rows of hairs on ventral surface; hind wings absent. (Pará, Brazil) .... **X. laura** sp n.

Tibiae without apical tufts of setae; hairs on ventral surface of tarsi, if present, not on segments 1-4 of all feet; hind wings present (?) 3

3(2). Disc of pronotum with granules more or less evenly distributed, without two submedian rows of granules 4

Disc of pronotum with two submedian longitudinal rows of fine granules 5

4(3). Elytra with a conspicuous row of coarse granules on basal three-fifths of third interval. Middle tibia with only one apical fringe of tomentum. (Matto Grosso, Brazil) .... **X. tarsalis** Hinton 1940.

Elytra without a row of coarse granules on third interval. Middle tibia with two apical fringes of tomentum. (Central America) .... **X. bufo** (Sharp, 1882).

5(3). Elytra without granules on basal part of third interval. (Santa Catharina, Brazil) .... **X. micros** (Grouvelle, 1888).

Elytra with a row of coarse granules on basal part of third interval 6

6(5). Elytra with row of granules on third interval extending to apical half and consisting of 19-20 granules; basal third with punctures of first two striae shallow and indistinct. (Matto Grosso, Brazil) .... **X. teres** Hinton 1946.

Elytra with row of granules on third interval confined to basal fifth or sixth and consisting of about 10 granules; basal third with punctures of first two striae deep and distinct 7

7(6). Species 1.6 mm long. First abdominal sternite with a short median carina. (Santa Catharina, Brazil and northern Argentina) .... **X. audax** Hinton 1946.

Species 1.4 mm long. First abdominal sternite without a carina. (Santa Catharina, Brazil; Paraguay; northern Argentina). .... **X. comis** Hinton 1946.

LITERATURE CITED

HINTON, H. E. 1936. Descriptions of new genera and species of Dryopidae (Coleoptera). Trans. R. Ent. Soc., Lond. 85 (18): 415-434, Plate 1.

.... 1940. A monographic revision of the Mexican water beetles of the family Elmidae. Novitates Zoologicae 42 (2): 217-396.

.... 1946. A key to the species of *Xenelmis* Hinton, with descriptions of three new species (Col., Elmidae). Ent. Mo. Mag. 82: 237-241.

DESCRIPTORS: Coleoptera; Elmidae; *Xenelmis;* key; new species; Brazil.
3.0013. Neotropical dryopoids 1. *Xenelmis laura,* a new species from Brazil (Coleoptera; Elmidae

ABSTRACT—BROWN, HARLEY P. (Zool. Dept., Univ. Okla., 730 Van Vleet Oval, Norman, Oklahoma 73069, U.S.A.) Neotropical dryopoids I. *Xenelmis laura,* a new species from Brazil (Coleoptera, Elmidae). Coleop. Bull. This species, described from the Rio Bananal, near Agua Azul in the state of Pará, differs from other known species is being wingless, in having apical tufts of setae on the middle and hind tibiae, and in having rows of hairs on the ventral surfaces of the basal four segments of all tarsi. In the distribution of pronotal granules it is intermediate between the *X. bufo* and *X. micros* species-groups. A key is included to all known species of *Xenelmis*.—Author.

(3.0016)

Silphidae Attraction to Carrion-Baited Air Cans Versus Carrion-Baited Ground Cans

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INTRODUCTION

A number of studies relating to carrion beetles and carrion have been conducted during the last 25 years. Dethier (1947) suspended squirrel carcasses in the air as bait. Milne and Milne (1944), and Reed (1958) simply placed their carrion baits on the ground, while Walker (1957) used ground cans in which the carrion was placed. All of these authors obtained interesting results in their studies but I have seen no published study comparing the attraction, to carrion beetles, of carrion situated in the air versus carrion placed on or in the ground. The 1964 data used in this paper were taken from a portion of my doctoral thesis (1967). The 1965 data, although obtained during my doctoral research studies, were not included in the thesis. All collecting was done in the William L. Hutcheson Memorial Forest, which is located near East Millstone, Somerset Co., New Jersey.

METHODS

Eight galvanized, one gallon cans were individually baited, each with an uncooked chicken leg. One set of 4, the ground cans, was buried with the open ends level with the surface of the soil. The open end of each can was fitted with a ½ inch wire screen cover to prevent loss of carrion but allow entrance of beetles. A sheet of galvanized metal, 1 foot square, was supported on stones to provide a clearance of about 3 inches around the rim and to keep out the rain (Walker, 1957). The 4 individual cans were sunk at points north, east, south, and west, each about 5 meters distant from a central stake.

A second set of 4, air cans described in a previous paper (Shubeck, 1968a), was suspended about 1.5 meters above the ground. Each one of the 4 air cans was situated in the immediate vicinity of each one of the 4 ground cans.

A fresh chicken leg was placed in each of the 8 cans on August 11, 1964 and carrion beetle collections were made 2, 4, 6, 9, and 11 days later. In 1965, a fresh chicken leg was placed in each can on July 17, and carrion beetle collections were made 3, 5, and 7 days later. The remains of the carrion were removed and replaced with fresh chicken legs on July 25, and collections made 2, 4, 6, 9, and 11 days later.

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RESULTS AND DISCUSSION

Six species of Silphidae were collected in the air and ground cans during August 11 to 22, 1964 and July 17 to August 5, 1965. Since only 3 individuals of *Silpha inaequalis* and 4 individuals of *Nicrophorus pustulatus* were recorded during this time no significance could be attributed to these numbers. Four other species were collected in larger numbers and those results are shown as bar graphs in Figures 1, 2, and 3.

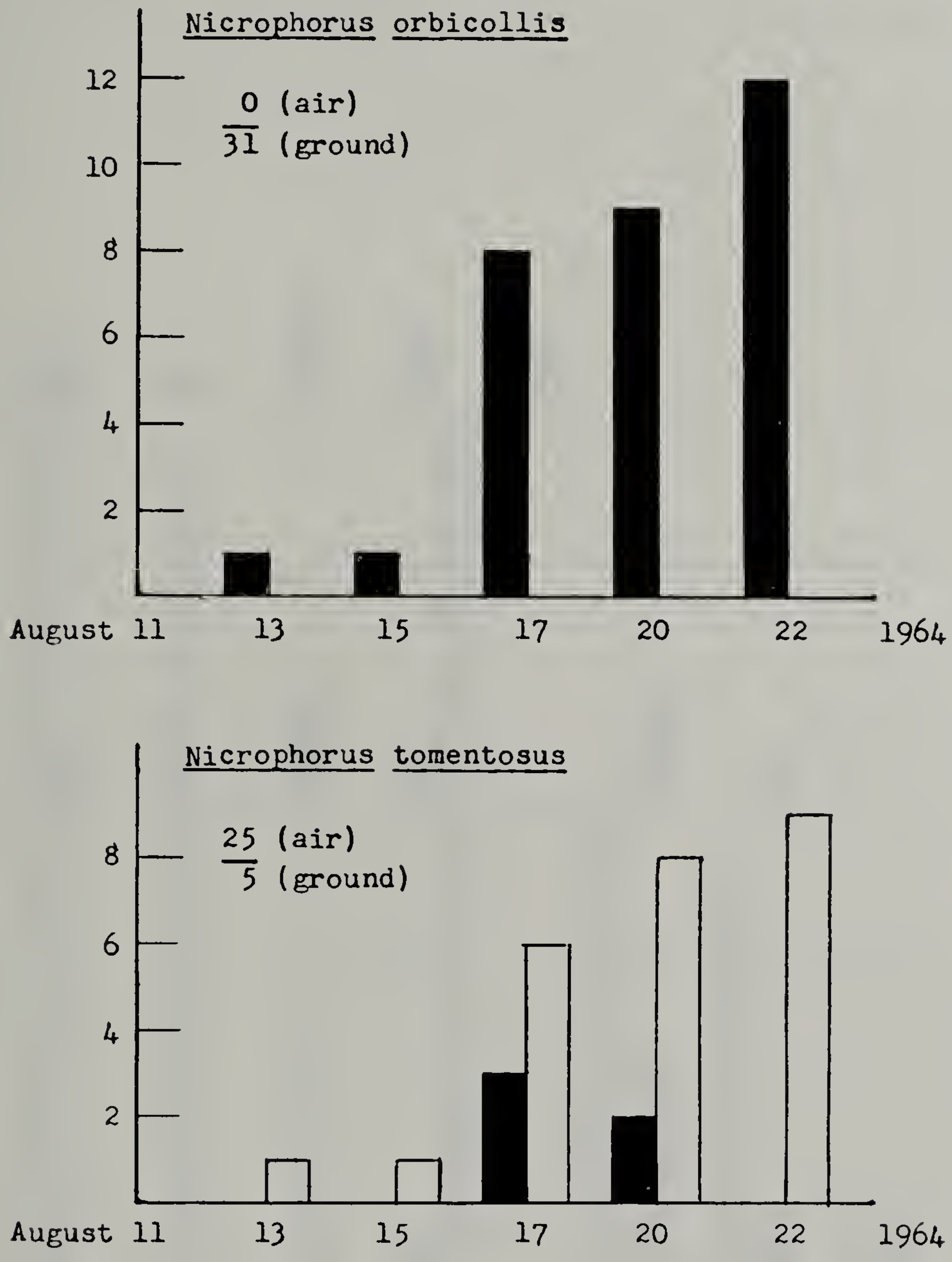

Fig. 1. Two species of Silphidae collected during middle August, 1964. Shaded bars show numbers collected in ground cans while hollow bars show numbers collected in air cans.

In 1964, virtually equal numbers of *Nicrophorus orbicollis* and *N. tomentosus* were collected (Fig. 1). Not one individual of the former species was taken in the air cans whereas 31 individuals were taken in the ground cans. *N. tomentosus*, on the other hand, manifested a much higher attraction for the carrion-baited air cans. Of the 30 individuals taken, 25 or 83.3% were taken in the air cans.

The results in 1965 (Fig. 2) were slightly to moderately different. These samples were collected earlier in the season before the Nicrophorus populations had reached their summer peak (Shubeck, 1969) and there may have been less competition between the two species in terms of locating carrion. *Nicrophorus* *orbicollis* was found almost equally in air cans and ground cans and the total number was about half the total number of *N. tomentosus* collected. Sixty-one percent of the latter species was taken in air cans and the remainder in ground cans.

Although the studies were conducted during parts of two summers, the periods of time complement each other and it was decided to look also at the data in terms of "one extended period" of collecting from July 20 to August 22. The 50 individuals of *Nicrophorus orbicollis* were thus seen to manifest a 9:41 ratio (air:ground), or 18% being collected in air cans and 82% in ground cans.

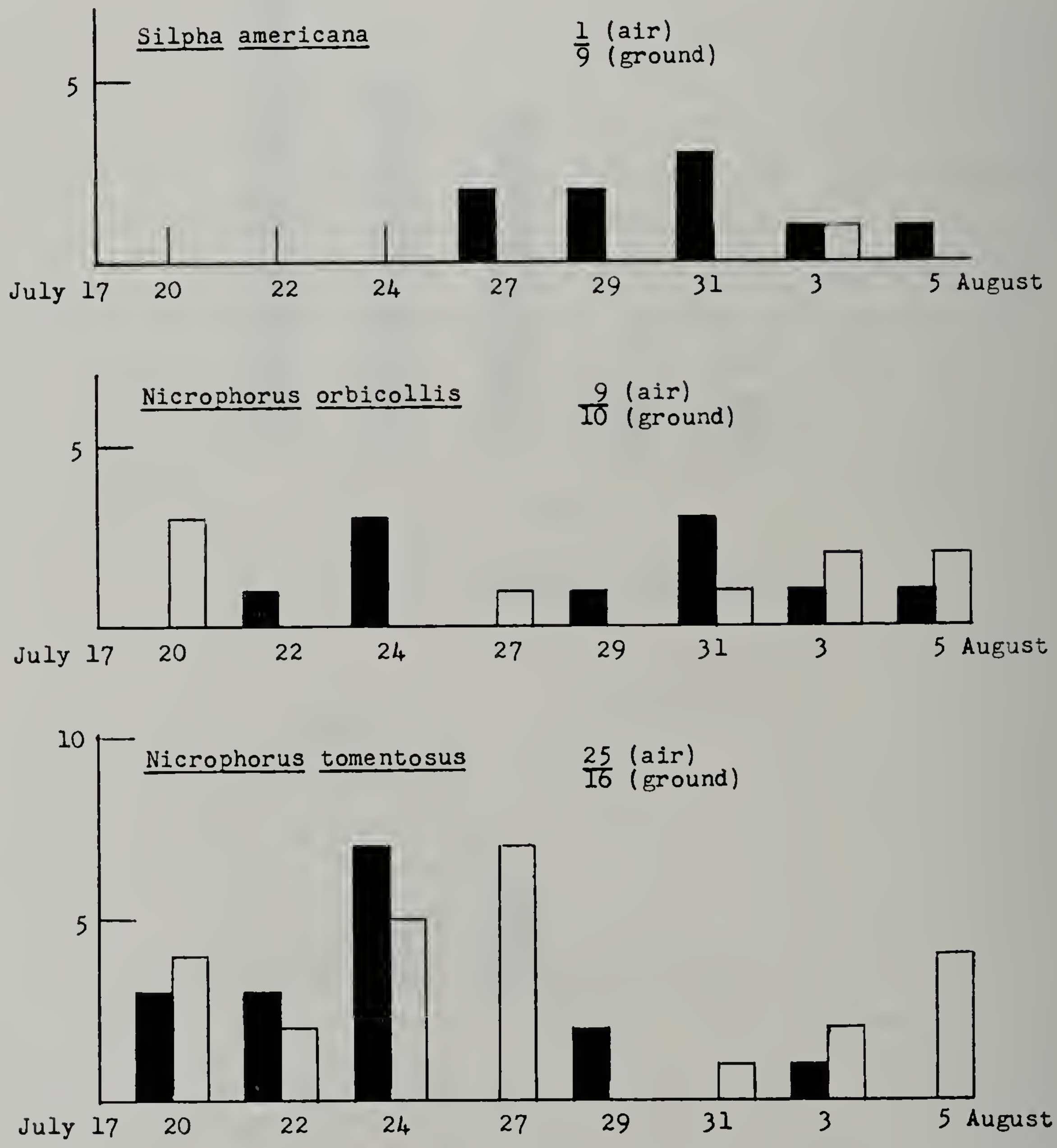

Fig. 2. Three species of Silphidae collected during late July and early August, 1965. Shaded bars show numbers collected in ground cans while hollow bars show numbers collected in air cans.

Nicrophorus tomentosus seemed to have the opposite preference, and of 71 individuals 50 or 70.4% were collected in the carrion-baited air cans, and 29.6% in the carrion-baited ground cans. It should be noted that this species is slightly smaller, more active, and more aggressive than *N. orbicollis* (Shubeck, 1967). The former seems to have the ability to fly directly to carrion. It is probable that the latter species lands in the general vicinity of carrion and then walks to it.

Both Silpha species showed a strong preference for the ground cans as compared to the air cans. Only 10 individuals of *Silpha americana* were taken but 9 of them were collected in the ground cans (Fig. 2). The data for *Silpha noveboracensis* are especially meaningful because of the size of the total sample (Fig. 3). Of 125 individuals collected, 108 or 86.4% were attracted to the ground cans. It seems quite probable that *Silpha noveboracensis* and possibly *S. americana,* as a result of random movement and/or anemotaxis, reach the approximate vicinity of carrion, and then walk the final distance. A previous study, in fact, presents strong evidence that *Silpha noveboracensis* in Hutcheson Memorial Forest locates carrion by means of random movement (Shubeck, 1968b). A small percentage (13.6%), do however, have the ability to orient directly to carrion, even when the carrion-baited air can is suspended above the ground.

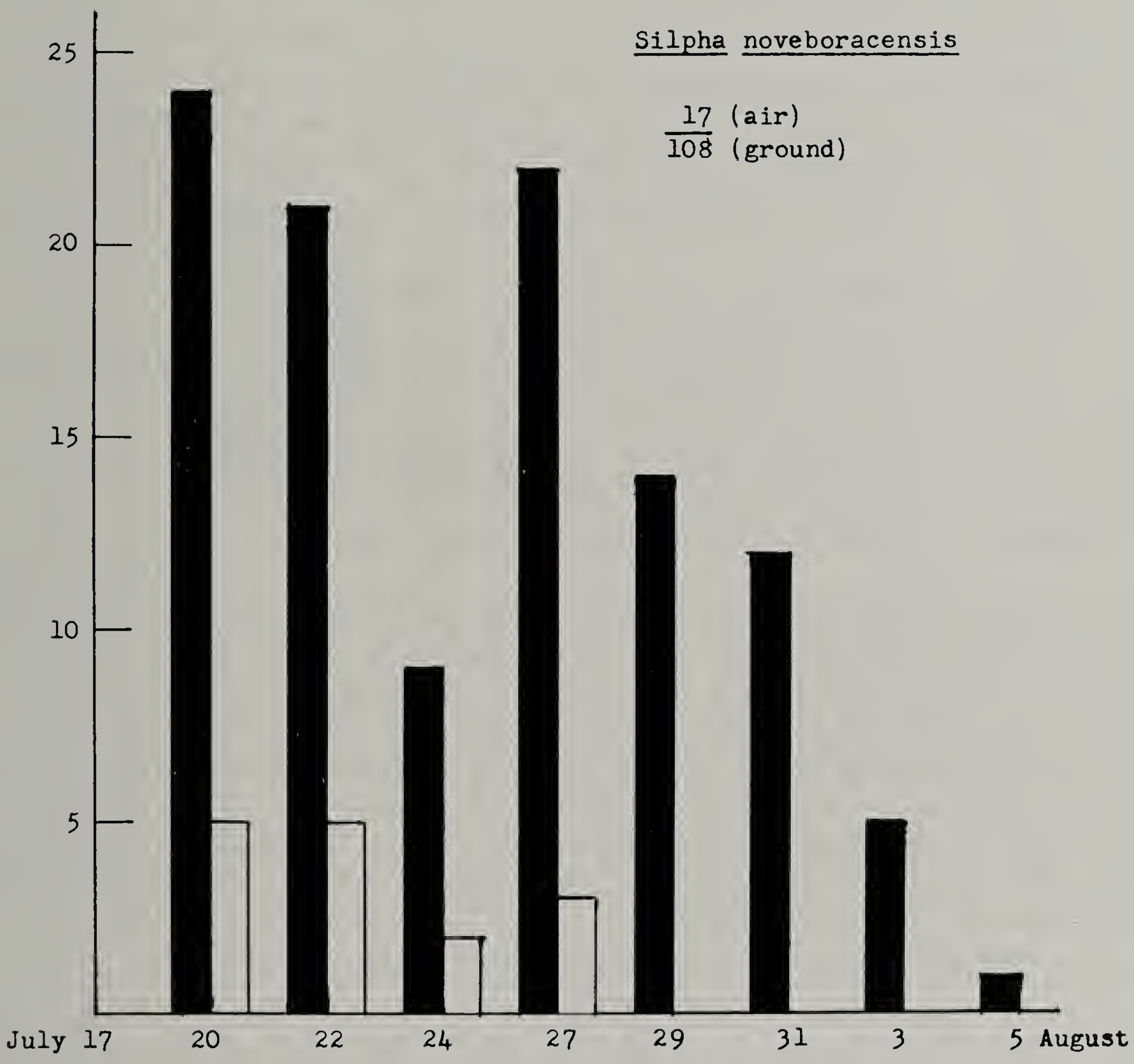

Fig. 3. The dominant species of Silphidae collected during late July and early August, 1965. Shaded bars show numbers collected in ground cans while hollow bars show numbers collected in air cans.

CONCLUSIONS

Given the choice of carrion-baited air cans and carrion-baited ground cans, 4 species of Silphidae in Hutcheson Memorial Forest were observed to manifest very strong preferences (70% to 90%) for one type or the other. *Nicrophorus orbicollis, Silpha americana,* and *S. noveboracensis* were attracted primarily to the ground cans. The air cans, on the other hand, were most attractive to *Nicrophorus tomentosus.*

ACKNOWLEDGMENTS

I would like to thank the Hutcheson Memorial Forest Committee, of Rutgers University, for encouraging me in my Silphidae research in Hutcheson Memorial Forest.

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3.0016. (Silphidae attraction to carrion-baited air cans versus carrion-baited ground cans. —Paul P. Shubeck)

ABSTRACT: Silphidae attraction to two kinds of carrion-baited traps was studied in Hutcheson Memorial Forest, East Millstone, New Jersey. Four cans, suspended in the air, and four cans, buried with the open ends flush with the surface of the soil, were individually baited with a fresh chicken leg. Five collections were made during August 1964, and eight collections were made during July and August 1965. Of six species of Silphidae collected in these cans, four species were taken in numbers large enough to give an indication as to their preferences of carrion-baited ground cans versus carrion-baited air cans. *Nicrophorus orbicollis, Silpha americana,* and *S. noveboracensis* were attracted primarily to the ground cans while *N. tomentosus* strongly preferred the air cans.

DESCRIPTORS: Coleoptera; Silphidae; attraction to bait; New Jersey.

(3.0019)

A Review of the Genus *Nipus* Casey (Coleoptera: Coccinellidae)

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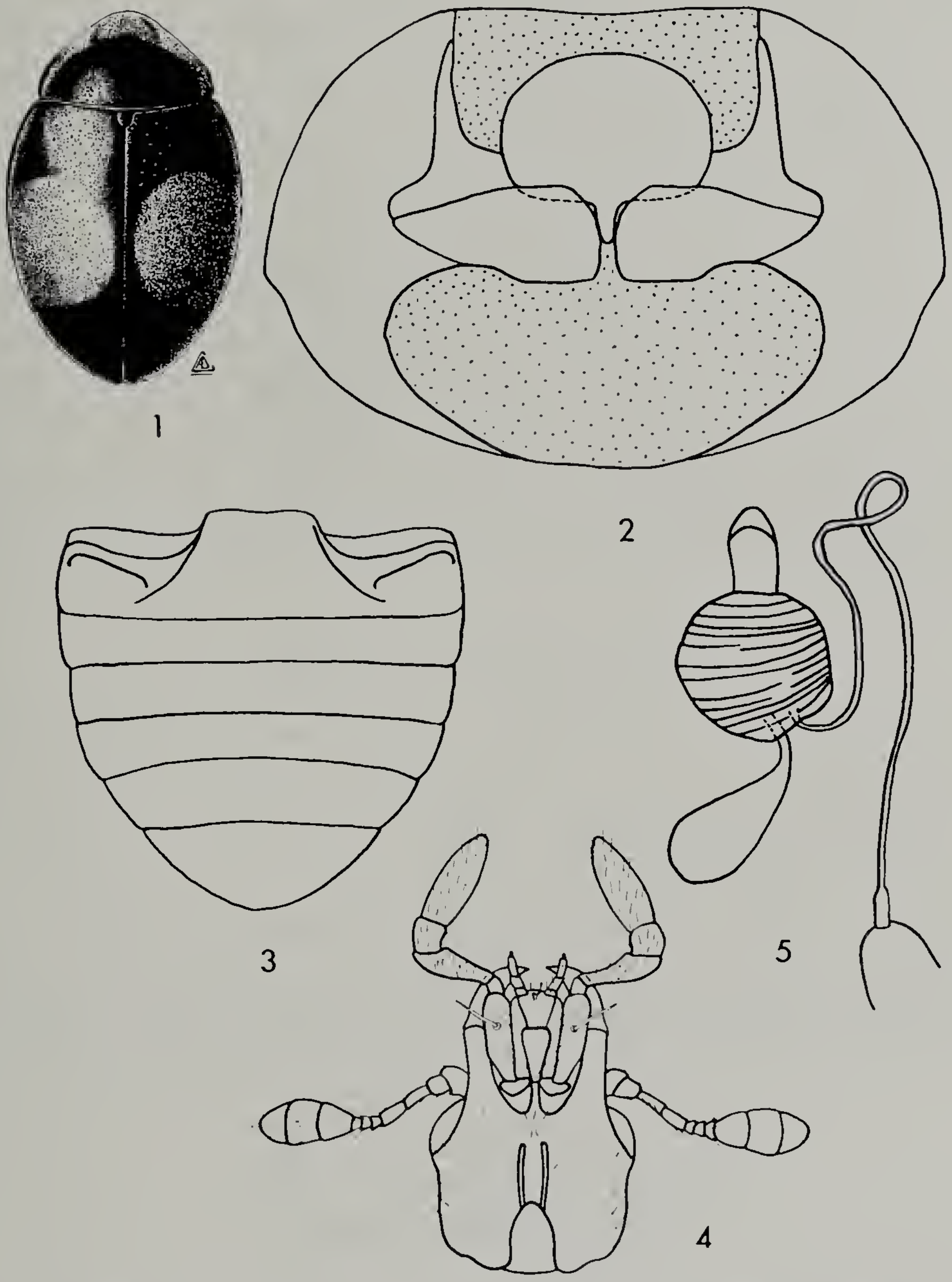
The tribe Cranophorini was proposed by Casey (1899) for the North American genus *Nipus* Casey, the South African genus *Cranophorus* Mulsant, and the Neotropical genus *Oryssomus* Mulsant. Since then, 5 other genera have been placed in the tribe by various authors.

Nipus must be removed from the Cranophorini and placed in the Sticholotini near *Microweisea* Cockerell. The only character that *Nipus* shares with the other genera in the Cranophorini is the concealed head. The elongate head, long maxillary palpus with conical last segment, asymmetrical male genitalia



Figs. 1-5. Fig. 1, *Nipus occiduus,* n. sp. Fig. 2, *Nipus biplagiatus,* prosternum. Fig. 3, *Nipus occiduus,* n. sp., abdomen. Fig. 4, *Nipus occiduus,* n. sp., underside of head. Fig. 5, *Nipus biplagiatus,* spermatheca, sperm duct, accessory gland.

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and prosternum with an anterior lobe are characteristic of a group of genera presently included in the Sticholotini. These are the South American genera *Coccidophilus* Brèthes and *Stictospilus* Brèthes, the North American genera *Microweisea* Cockerell, *Cryptoweisea* Gordon, and *Gnathoweisea* Gordon. *Nipus* is distinct from these 5 genera in having the head concealed beneath the pronotum.

The habitus view of *Nipus occiduus,* n. sp., was prepared by Arthur Cushman.

Nipus Casey

Nipus Casey, 1899, pp. 132-133. Type-species *Nipus biplagiatus* Casey, by subsequent designation of Korschefsky 1931.

Form elongate-oval, convex, upper surface with short, sparse, erect pubescence. Pronotum elongate, anterior margin not emarginate, produced forward, concealing head in dorsal view. Head elongate, clypeus prolonged anterior to antennal insertion. Antenna inserted dorsolaterally, anterior to eye, 10-segmented: first segment large, twice as long as second; second short; third and fourth long, slender; fifth, sixth and seventh similar and nearly equal; eighth, ninth and tenth forming a club, ninth segment slightly longer than others in club (fig. 4). Terminal segment of maxillary palpus not securiform, narrowing apically (fig. 4). Labial palpus short, inserted at apex of labium (fig. 4). Prosternum with anterior lobe pronounced, semicircular, nearly concealing mouthparts in ventral view (fig. 2). Elytral epipleura narrow, horizontal, not foveolate for reception of the femoral apices. Abdomen with 6 visible sterna (fig. 3). Metacoxal arcs incomplete, inner line extending diagonally from intercoxal process two-thirds the distance to hind margin of sternum, outer line extending from near lateral margin of sternum along posterior margin of coxal cavity, abruptly turning downward before reaching inner line (figs. 3, 6). Legs with femora slightly thickened, tibiae slender, tarsi 3-segmented, tarsal claws thickened at base, without basal tooth (figs. 12, 13, 14). Male genitalia: basal lobe knife-like, longer than parameres, asymmetrical; parameres unequal, left paramere very short, right paramere long; sipho slightly tapering in apical one-third, abruptly narrowing before apex. Female genitalia: (fig. 5) spermatheca round, ball-like; cornu prominent, parallel sided; sperm duct long; infundibulum present; genital plates elongate triangular, styli present.

Key to Species of *Nipus*

1. Each elytron with a pale red or yellow spot, or a red or yellow band across elytra 2
   Elytra without spot or band 3
2. Body elongate, parallel-sided; California .... **biplagiatus** Casey
   Body elongate-oval, not parallel-sided; Arizona, Utah .... **occiduus,** n. sp.
3. Elytra brownish piceous, margin not paler; coarsely and densely punctured;
   California .... **niger** Casey
   Elytra dark brown, each elytron with lateral and sutural margins pale; punctures fine, sparse;
   Arizona .... **planatus,** n. sp.

Nipus biplagiatus Casey
(Figs. 6, 9, 10, 12, 14)

Nipus biplagiatus Casey, 1899, p. 133.

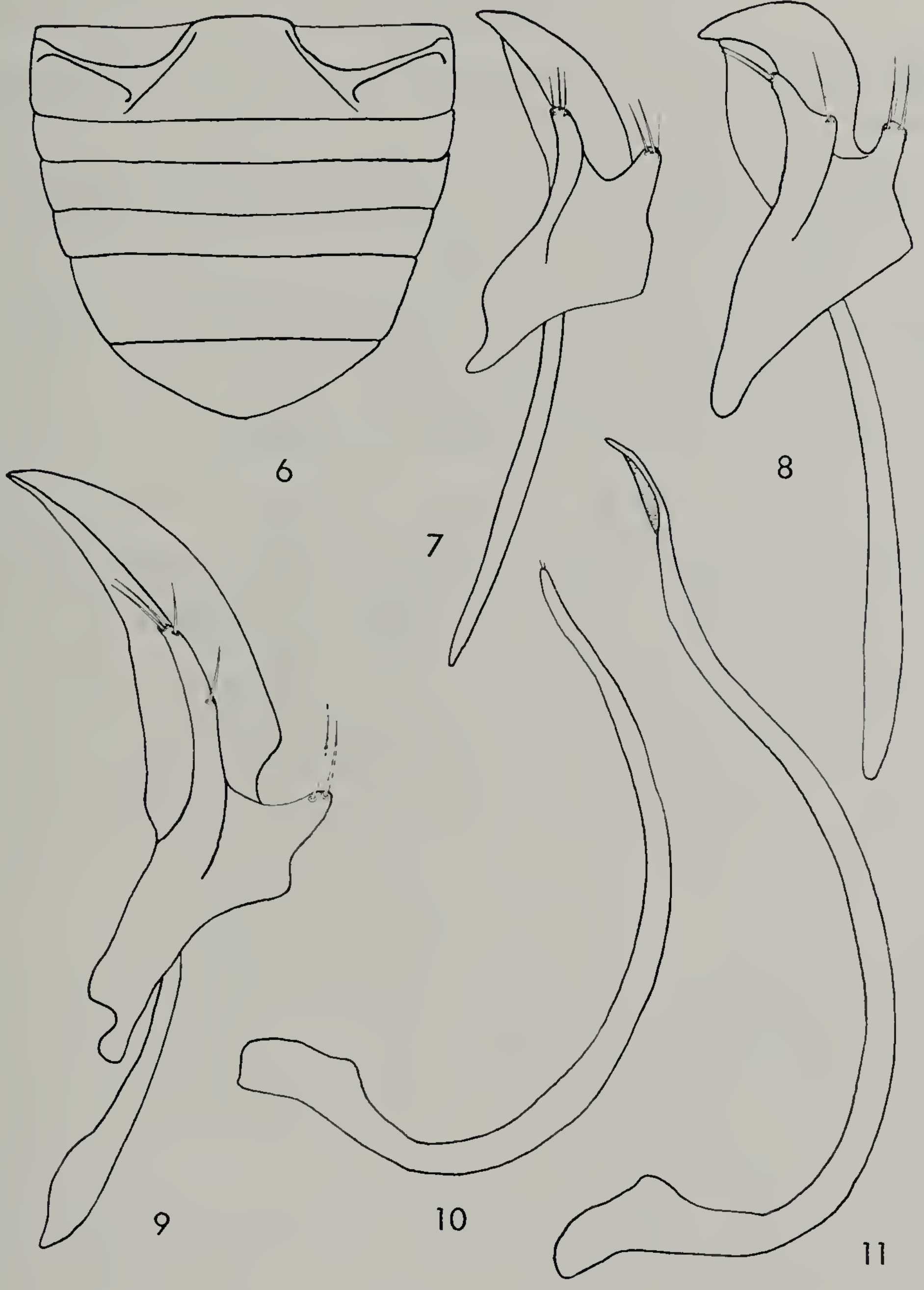
Male and female.—Length 1.25 to 1.50 mm., width 0.75 to 0.82 mm. Form elongate, parallel-sided, abruptly narrowing posteriorly. Color piceous, a large median spot on each elytron and anterior margin of pronotum yellow, ventral surface uniformly yellowish brown. Pronotum lacking punctures except at base, strongly alutaceous. Elytra smooth, shining, coarse punctures separated by their diameter or less. Male genitalia with basal lobe long, twice as long as right paramere (fig. 9); sipho abruptly tapering before apex, apex slightly twisted (fig. 10).

Variation.—The elytral spots may be united at the suture, giving the appearance of a broad band rather than individual spots.

Type locality.—Los Angeles, California.

Type depository.—U.S. National Museum of Natural History.

Distribution.—Southern California.



Figs. 6-11. Fig. 6, *Nipus biplagiatus,* abdomen. Figs. 7-11, male genitalia. Fig. 7, *Nipus planatus,* n. sp., lateral view of phallobase; fig. 8, *Nipus occiduus,* n. sp., lateral view of phallobase; fig. 9, *Nipus biplagiatus,* lateral view of phallobase; fig. 10, *Nipus biplagiatus,* sipho; fig. 11, *Nipus occiduus,* n. sp., sipho.

***Nipus niger* Casey**

Nipus niger Casey, 1899, p. 133.

Female.—Length 1.05 mm., width 0.70 mm. Form elongate-oval, gradually narrowing posteriorly. Color brownish piceous, anterior margin pale, undersurface brown. Pronotum lacking punctures except at base, strongly alutaceous. Elytra smooth, shining, coarse punctures separated by less than their diameter.

Type locality.—Sonoma County, California.

Type depository.—U.S. National Museum of Natural History.

Distribution.—Specimens seen from Humboldt, Santa Clara and Sonoma Counties, California. No males were available for examination. The type is a female as are the other 5 specimens in the NMNH collection.

Nipus planatus, n. sp.

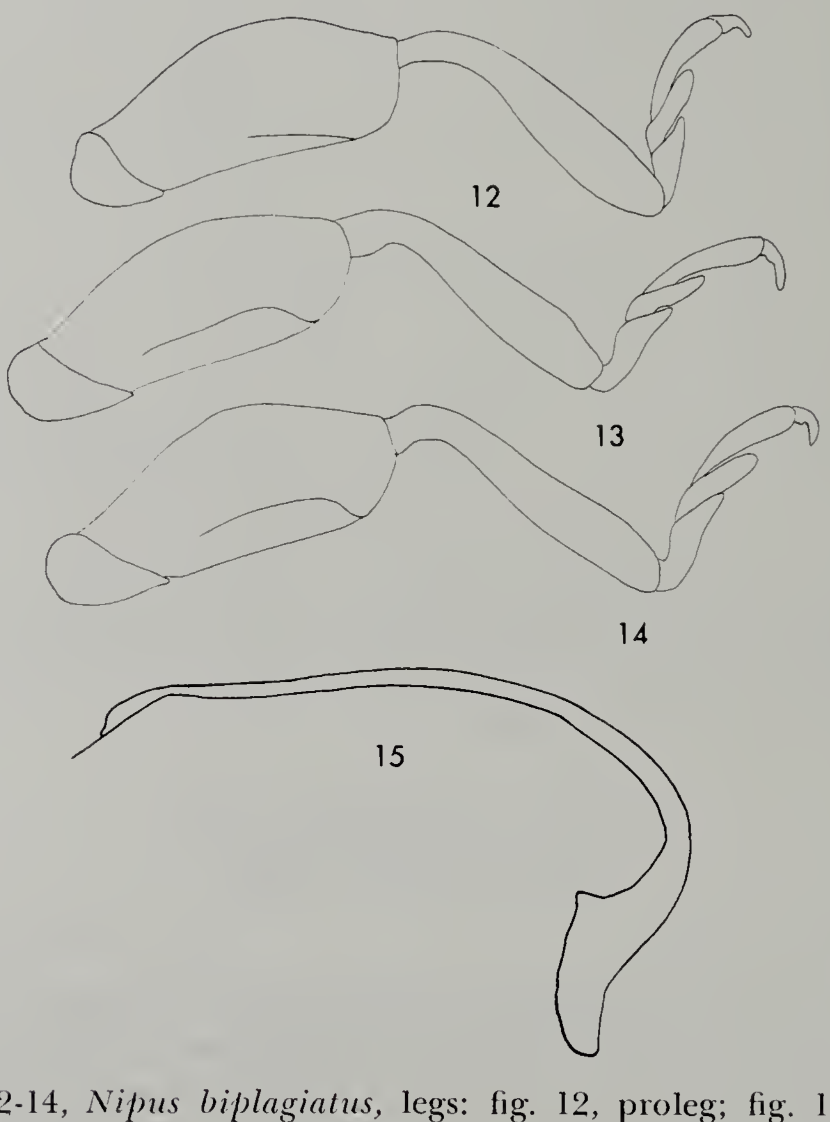
(Figs. 7, 15)

Holotype male.—Length 1.20 mm., width 0.82 mm. Color dark brown, nearly piceous, a narrow margin completely surrounding each elytron and anterior and lateral margins of pronotum yellowish brown, underside brown, mouthparts and legs yellowish brown. Pronotum strongly alutaceous, faintly punctured at base, pubescence sparse, decumbent. Elytra shining, not alutaceous, finely punctured, punctures separated by 2 to 3 times their diameter. Genitalia with basal lobe short, broad, apex not abruptly bent downward, left paramere very short, broad, right paramere long, narrow (fig. 7); sipho constricted slightly before apex, apex thickened, narrowing to a fine point, bent downward (fig. 15).

Variation.—Length 1.19 to 2.24 mm., width 0.81 to 0.84 mm.

Holotype.—Salida, Colorado, VII-6, Wickham, Wickham collection (U.S. NMNH 70851).

Paratypes.—(3) 2, Bright Angel Camp, Ariz., VII-14, 6900 ft., Wickham; 1, Bright Angel Camp, Ariz., VII-15, 6900 ft. Wickham. All paratypes in NMNH collection.



Figs. 12-15. Figs. 12-14, *Nipus biplagiatus,* legs: fig. 12, proleg; fig. 13, middle leg; fig. 14, hind leg. Fig. 15, *Nipus planatus,* n. sp., sipho.

***Nipus occiduus*, n. sp.**

(Figs. 1, 3, 4, 8, 11)

Holotype male.—Length 1.21 mm., width 0.75 mm. Color piceous, a spot on each elytron and the anterior margin of pronotum yellowish brown, underside piceous, legs and mouthparts slightly paler. Pronotum strongly alutaceous, faintly punctured basally, pubescence sparse, decumbent. Elytra shining, not alutaceous, punctured, punctures separated by slightly more than their diameter. Prosternum, elytral epipleura and metasternum faintly alutaceous, indistinctly punctured. Abdominal sterna strongly alutaceous, faint punctures separated by their diameter or more. Genitalia with basal lobe very short, broader than long, apex abruptly bent downward, left paramere short, broad, right paramere elongate, narrow (fig. 8); sipho constricted slightly before apex, apex bent downward (fig. 11).

Variation.—Length 1.20 to 1.24 mm., width 0.75 to 0.78 mm. The pale spot on each elytron occupies one-half to two-thirds of the elytron.

Holotype.—Wasatch, Utah, 27-6, coll. Hubbard & Schwarz (U.S. NMNH 70852).

Paratypes.—(5) 2, Santa Rita Mts., Ariz., 11-6, Coll. Hubbard & Schwarz; 1, Chiricahua Mts., Ariz., 206, coll. Hubbard & Schwarz; 1, Oracle, Ariz., 6-7, coll. Hubbard & Schwarz; 1, Millers Canyon, Huachuca Mts., Ariz. All paratypes in NMNH collection.

Two other specimens from Williams, Arizona, are tentatively placed as this species; both are females and are teneral.

N. occiduus closely resembles *N. biplagiatus* in external appearance. *N. occiduus* is not as elongate and parallel-sided as *biplagiatus* and the male genitalia are quite different. So far the ranges of the two species are not known to overlap.

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Descriptors: Coleoptera; Coccinellidae; *Nipus;* new species; key; Arizona, southern California, Colorado, and Utah.

3.0019. A review of the genus *Nipus* Casey (Coleoptera: Coccinellidae)

Abstract—Two new species of *Nipus* from Arizona, southern California, Colorado, and Utah *N. planatus* and *N. occiduus* Gordon are described and the genus reviewed.

(3.0021)

Objectives of a Taxonomic Catalog of Coleoptera[1]

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The leaders of modern biology have for many years glamorized some kinds of research, especially research using sensitive measuring devices. Their collection of adjectives describing this work is rivaled only by commercial advertising. They have succeeded in luring many of our best students into three specialized areas of biology which have since become highly competitive, low data-yielding, and very restrictive. These areas are molecular, cellular, and developmental biology. Interesting as they may be, they are no more dynamic than that less specialized, high data-yielding branch of biology which has suddenly become very popular, environmental biology. However, if some branches of biology are able to attract students, it is because it is made interesting and challenging. The environmental biologists, until recently, have failed to do the same, mainly because they have not seen how their premises, procedures, and product fit into the scheme of biology, and they seem to fail to see that this now, suddenly much needed area, has glamour and value.

A taxonomic catalog of organisms looks to be far from any of these biological worlds, yet, catalogs are a vital part of several coordinated projects needed for any environmental study, for all must deal with organisms as a part of the environment. The populations of these organisms, the species they form, and even their adaptive evolution, are first considerations in all environment studies.

In order to appreciate the processes, balances, and checks operating in the effective environment, one must know not only the orders and families that occur in the habitats, but also the species and their populations. There is no such thing as the biology of an order, or the ecology of a family. Neither families nor genera function in an environment. Only the individual of a species have functions. It is impossible to experiment with the genetics of a family or a genus. The environment or habitat of a family cannot be known. Selection takes place only through individuals and it is only the progeny of individuals that can evolve. Since individuals usually mate only with other individuals of their own species, it follows that information gathered about individuals as members of a common gene pool may be extended within the confines of logical scientific procedure to apply to a population. Accuracy of these studies must be dependent upon the accuracy of the identification of the populations of the organism. This must start with taxonomic information packages about species, and taxonomic information retrieval begins with a descriptive catalog!

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[1] Journal paper no. 4183 of the Purdue University Agricultural Experiment Station, Lafayette, Indiana.

How can cataloging be a dynamic, interesting, and a challenging part of environmental biology? After all, it deals with nothing but ancient literature, long since useless and generally superseded by more modern works, or so it would seem. The one way to make it interesting is to relate taxonomic data to natural, living populations as they occur in the field. Since population biology is one of the areas of current interest, the objectives of a catalog should relate population and environment. A handbook of the proper nomenclature of North American Coleoptera, for example, could refer directly to the beetle populations by restricting, so far as possible, the nominal population (=type) locality, and indicating the range of the concomitant populations. (These terms are defined later in this paper). The researcher may then make his identifications and relate the data on the populations with these names, as well as with the previously published data. Details of this method have been outlined by the author previously (Arnett, 1970a).

A further objective of a catalog is to provide a checklist of the species of more restricted areas for the use in faunistic studies. These two objectives are considered in particular and in some detail in the sections that follow.

The arrangement of species by distribution areas described below is an innovation proposed only after considerable study and weighing of many factors. It is not yet possible to arrange species by natural faunal areas, and it is problematical if this ever will be done. Fauna regions, as opposed to geographical regions, have certain inherent difficulties. The habitat requirements of the species of most genera of any region are varied; this is a biological requirement, and a part of any species isolating mechanisms. But, even so, certain trends are evident in some or most of the well defined genera so far as the actual geographical distribution of the species is concerned. This has enabled me to devise the system proposed here, based on political boundaries which obviously have little natural basis. Some habitats coincidently are roughly outlined by these regions so that the areas selected do approach our original hope to some extent for a system of natural faunal areas. For example, area 6, the arid southwest, is approximately equal to the western arid region. Examples of this kind of distribution pattern can be found in many groups.

The usefulness of this politically based system are several. For example, it may be of service to those involved in pest management projects confined to a single state. Regional handbook preparation is facilitated by such a list. The reduction of the large genera into smaller units by regions greatly aids one to comprehend the fauna. It eliminates also the confusion of dealing with closely similar species because the most easily confused species generally are found in separate regions. If this system is accepted and used for faunistic studies, it should help to bring the alpha taxonomy of these areas to more rapid completion and open the way for more detailed studies of the beetles of those regions.

A CATALOG SHOULD:

Provide a means of relating nomenclature (or retrieval coding) to the natural species and their populations.

Provide a checklist of the species of more restricted areas for faunistic studies.

GEOGRAPHIC SCOPE

There has never been a complete catalog of the Coleoptera of North America. Previous catalogs have omitted Mexico, mostly because of the limited knowledge, or supposed lack of data, from this large and interesting country. Collecting and research in Mexico since 1945, both by the Mexicans and by visitors from the United States and Canada have brought our knowledge of this region to the point making it possible to write a working catalog of the area. The same is true of Alaska; so that now the geographic scope of a catalog can be enlarged over any previous catalog to include all of the area usually referred to as North America. This usually comprises Canada, United States, and Mexico. However, the remainder of Central America and the West Indies, while not well known, may be incorporated as well. Although Greenland is sometimes considered a part of North America, it is not so regarded here. The islands of Bermuda, and other Atlantic Ocean islands are not zoogeographically a part of this region. However, the Aleutian Islands, and the islands off the coast of California and Mexico are a part.

The areas selected for a faunistic and descriptive catalog appear on the map (fig. 1) and the regions are named and described here. The numbers refer to the region as shown on the map. These numbers are used in the list of species in the catalog as a convenient means of showing additional ranges of a species. In addition, each country and state or province has been assigned a number to be used for computer indexing. These numbers may have associated with them a lot number or locality number for further compact data recording. Thus the range of a species may be coded and retrieved in these three ways.

GEOGRAPHICAL SUBREGIONS OF NORTH AMERICA

1. North Western North America. Western Canada: the provinces of Yukon Territory, District of Mackenzie, British Columbia, Alberta, and Saskatchewan, and Alaska.

2. North Eastern North America. Eastern Canada: District of Keewatin, Manitoba, Ontario, Quebec, Newfoundland, New Brunswick, and Nova Scotia, except for southern Ontario and southern Quebec (see map).

3. Pacific Coast. Washington, Oregon, and California.

4. Northwestern United States. Idaho, Montana, North and South Dakota, Wyoming, Nebraska, Nevada, Utah, Colorado, and Kansas.

5. Northeastern United States and Adjacent Canada. Minnesota, Wisconsin, Michigan, New York, southern Ontario and southern Quebec south of the 47th parallel (see map), the New England States, Iowa, Illinois, Indiana, Ohio, Pennsylvania, New Jersey, northern Missouri (north of the Missouri River; see map), Kentucky, Virginia, Maryland, Delaware, and the District of Columbia.

6. Arid Southwest. Arizona, New Mexico, Oklahoma, Texas, Baja California, Sonora, Chihuahua, Coahuila, Nuevo Leon, and Tamaulipas.

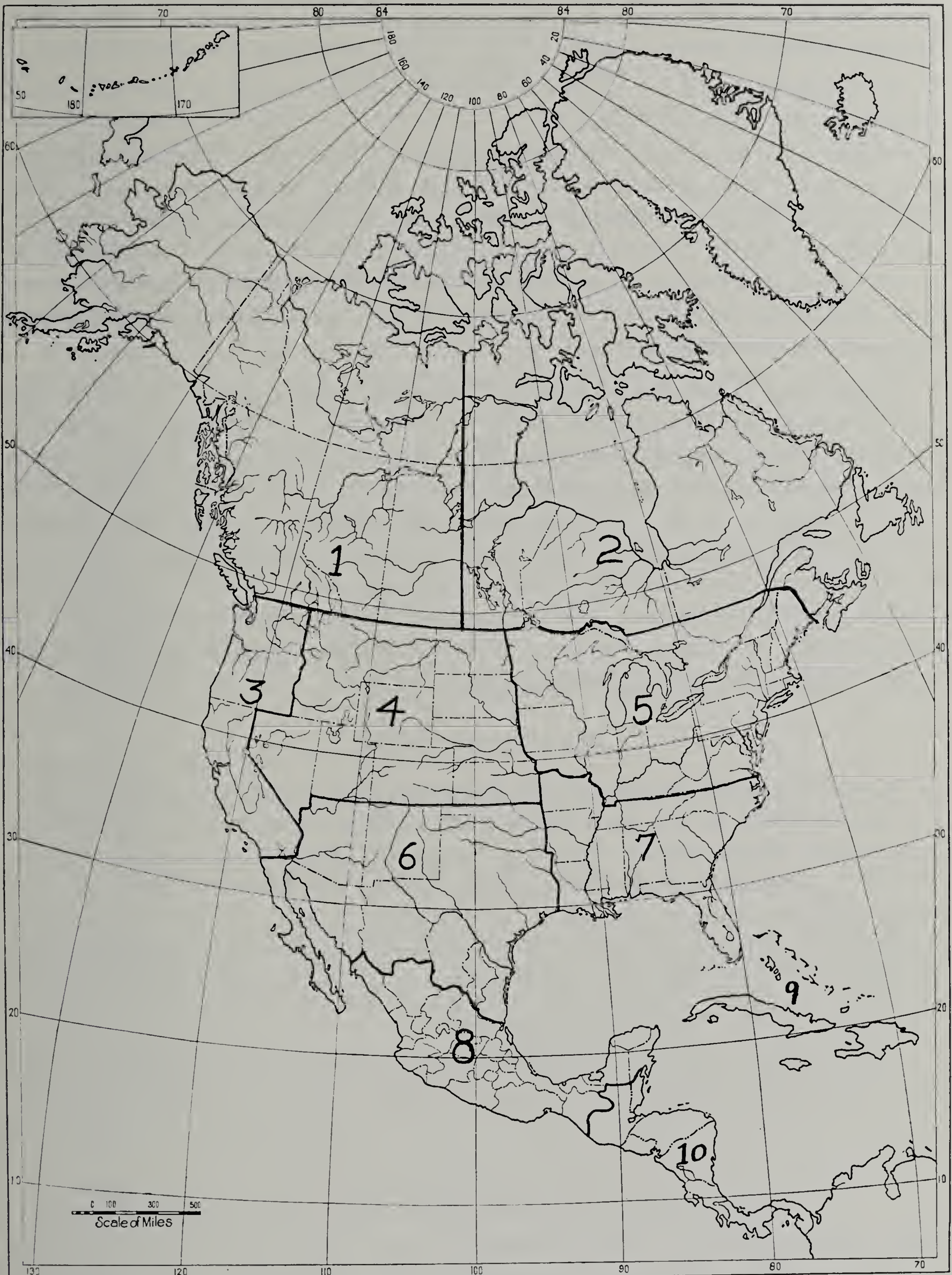

Fig. 1. Map of North America showing regions used for cataloging purposes.

7. Southeastern United States. Southern Missouri (south of the Missouri River; see map), Tennessee, North Carolina, Arkansas, Louisiana, Mississippi, Alabama, Georgia, South Carolina, and Florida, including the Florida Keys.

8. Southern Mexico. All of the states of Mexico south of the arid states included in the Arid Southwest.

9. West Indies. All of the West Indian islands except Trinidad, Tabago, and the Dutch West Indies islands of Aruba, Bonaire and Curaçao. The West Indies are usually divided further as the Greater Antilles and the Lesser Antilles. The latter are further broken into the Leeward and the Windward island groups.

10. Central America. This region includes the countries of British Honduras, Honduras, Guatemala, Nicaragua, Costa Rica, Panama, and the coastal islands of each of these countries.

These areas should be indicated by number and name in a catalog and the species should be arranged under the regions in which they occur. A species that ranges throughout more than one section may be listed as many times as necessary. The range of monobasic species is described by listing each region in which it occurs with details of its distribution under each of these sections. The citation to the original description, other references, and data, are to be given only after the binominal listing under the area in which the nominal population occurs. The preparation of these data for inclusion in a computerized information bank is discussed elsewhere (Arnett, 1970b). An example of this method is shown in figure 2.

BIBLIOGRAPHIC SCOPE

A catalog should include all the literature from January 1, 1758 but only if it was included in the Junk/Schenkling Catalog, the Leng Catalog and its supplements, Blackwelder's checklist, Zoological Record, and other readily available literature sources. No attempt should be made to check beyond these references because no system is available to assure complete retrieval. The obscure literature missed by this arbitrary, but objective, restriction will not yield data of significance. The security of this objective method of work limitation is worth the sacrifice of integrity.

The system of citation of literature is now more or less standard. The author, date of publication, and the page number is given as a reference in the catalog. The full citation is given in the bibliography which follows the catalog proper. The bibliography is arranged alphabetically by author, and actual date of publication. If more than one publication appears during the same year by the same author, each are given a letter (e.g., Smith, 1958a; Smith, 1958b; Smith, 1959, etc.). If the publication date differs from the date printed on the publication, the printed date appears in parenthesis at the end of the citation, but only in the bibliography; the text always lists the actual date of publication. Any annotation of the references other than original descriptions appear within square brackets in the text proper. Distribution of the species may be listed in two ways. It may be restricted to the published records (the best and most objective way) or it may list localities summarized

SAMPLE CATALOG

(Selected species)

Genus **OXACIS** LeConte

Oxacis LeConte, 1866: 165.

Type species: *Asclera cana* LeConte (Arnett, 1950: 223).

3. PACIFIC COAST

(See *O. bitomentosa; O. sericea; O. megathoracica; O. fragilis; O. xerensis; O. pallida,* and *O. nitens.)*

4. NORTHWESTERN UNITED STATES

bitomentosa Arnett, 1960: 35.

Type locality: USA: Nevada, Clark Co., Colorado River Canyon. 3. USA: s. California; 6. USA: w. Arizona; MEXICO: Baja California; Sonora; 8. MEXICO: Sinaloa.

sericea Horn, 1870: 89.

Type locality: USA: Nevada, "central". 3. USA: Oregon, California; 6. USA: Texas; New Mexico; Arizona; MEXICO; Sonora; Chihuahua; Coahulia; 8. MEXICO: Durango.

(See also: *O. fragilis; O. pallida; O. nitens; O. trirossi.)*

5. NORTHEASTERN UNITED STATES AND ADJACENT CANADA

(See *O. trirossi.)*

6. ARID SOUTHWEST

megathoracica Arnett, 1960: 37.

Type locality: USA: Arizona, Yuma Co., Ehrenberg. MEXICO: Baja California; 3. USA: s. California.

fragilis Horn, 1896: 413.

Type locality: MEXICO: Baja California, San José del Cabo. Sonora; USA: Arizona; New Mexico; 3. USA: s. California; 4. USA: s.w. Colorado.

Fig. 2. Sample catalog entries for selected species.

from locality labels on specimens in collections. If the latter method is followed, it is absolutely necessary, if repetition of work is to be avoided, that the collection and date of listing be recorded as a part of the catalog. Obviously, this latter method should be used when writing monographs rather than catalogs. The catalog should not include these kinds of original data. The most useful way of recording distribution is by confining the list to published records, each of which should be cited.

Nominal Populations and Their Localities

The only way catalogs and the research that is necessary for their organization can have scientific objectivity is through the application of the concept of the nominal population. A *nominal population* is the breeding population to which the holotype specimen belongs. A *breeding population* is a natural population through which there is a free flow of genes. A *natural population* is any assemblage of individuals more or less confined, during their breeding season, to a definite geographical region and a definite habitat. Within the boundaries of this region there is a free flow of genes among these individuals, thus forming a breeding population. A natural population is one that occurs in a natural environment as opposed to a man-made, laboratory environment. A species is composed of one or more natural populations. The amount of communication between the populations varies from species to species, and this contributes in part, but not entirely, to the variation and degree of discreteness of the species. It is usually only by chance that a population becomes a nominal population; this only because the describer of a species selects a specimen as the holotype. The holotype is a specimen from a population, and by its designation, that population becomes the nominal population. Other breeding populations of the species become *concomitant populations.* The distribution or range of a species, therefore, is the range of the nominal and the concomitant populations.

Past taxonomic literature, and especially catalogs, seldom give the precise location of capture of the holotype specimen. The county, the state, but often only the country, is given as the locality of the holotype and the type series. The task for the biologist interested in these populations and their variation, if he wishes to name them in an objective manner, is to determine the range of the nominal population. This may be done by studying the species and its population to a sufficient extent so that, a) the amount of variation can be determined, and b) the population to which the holotype belongs can be determined. This can usually be done by a statistical study of the variation of the specimens and the placing of the holotype in the proper population according to the way it fits in the variation pattern. There are three possible ways that the nominal population (=type) locality may be indicated: 1) an arbitrary selection of a locality within the known range of the species. 2) The selection of a locality after a study of specimens throughout the range of the species by comparing these specimens with the original description of the holotype and selection of those that best fit. 3) By the same process as the previous, except that the holotype specimen is used instead of the description. Thus, a catalog should indicate the nominal locality shown as: (1) original designation; (2) subsequent designation by holotype; (3) subsequent designation by original description, (4) subsequent designation by arbitrary selection. Whenever possible, the nominal locality should be chosen from an area protected from industrial or agricultural exploitation. Game preserves, state or national parks, national forests, privately protected areas, field stations or biological stations owned by colleges or universities make ideal sites for type localities.

THE LIMITATIONS OF A CATALOG

A catalog is meant to serve the field biologist as a working tool. It is not complete in itself because it can cite only certain types of reference to the various taxa. As far as is known, all original descriptions of the categories genus and species and their infracategories should be cited. Subsequent references are made only when they give additional information about: 1) feeding habits; 2) habitats; 3) morphology; 4) life cycle; 5) behavior; 6) keys or descriptions useful for identification, and 7) distribution.

The type species of the genus is indicated and the method and place of fixation is cited wherever possible, but an attempt to make this exhaustive in the cataloging phase of the study may be impossible and there may be some errors. If, however, the citation of a species as a type of the genus results in many logically unnecessary nomenclatural changes, the changes should not be made in the catalog. This should be explained in all cases, but left for a thorough taxonomic study by a specialist.

All synonymy that is accepted is indicated either as "new synonymy" or the citation is given to show where first placed in synonymy. Synonyms are not accepted if there is doubt about the synonymy in terms of modern population studies. It is felt that it is better to treat doubtful cases as valid species rather than sink them to the obscurity of synonymy without really adequate cause.

Other limitations of a catalog will become apparent only with use. Hopefully, a catalog will be designed for and placed in an information bank. This is a separate topic discussed elsewhere (Arnett, 1970b). The cooperation of the specialists in submitting corrections or mentioning needed changes when they publish their data will be of great value to all biologists.

A catalog cannot contain a discussion of the classification of the order. This must remain for treatment elsewhere at another time. If claim to a reclassification is indicated in the title, it should be through the choice of categories and the arrangement of the various taxa. These changes are best published separately prior to the completion of the catalog.

It may be necessary to produce a catalog in stages. I suggest that parts be issued as compiled, when ready, but with a definite publication schedule. It would greatly speed the work and provide incentives if some systems were used to indicate the stage of refinement of the parts of the catalog. For example, a complete catalog compiled by using only *Zoological Record* references and recent catalogs might be produced and published in a limited edition, printed on pink paper to warn of the danger of its use due to its obvious limitations. As soon as the references are checked with the literature and appropriate adjustments made for any part of the "pink" edition, a new part might be issued in yellow; this "yellow" edition indicating that a further stage had been reached, but the part should be used with caution. The final, revised catalog, following the suggestion made in this paper could be issued on green paper signalling that it can be used as a reliable information source.

CLASSIFICATION CHANGES

As more is learned about any group of organisms, new taxa become necessary. When I wrote the "Beetles of the United States," I was intentionally conservative in the treatment of the family taxa. I now feel that there should be more families recognized if a proper balance is desirable. There is the practical advantage of making small working groups to permit comprehensive treatment of a family-group. Unfortunately, it is still not possible to break into family-groups, the eight largest families, Carabidae, Staphylinidae, Scarabaeidae, Buprestidae, Tenebrionidae, Cerambycidae, Chrysomelidae, and Curculionidae. European workers have broken these families into many smaller ones but without adequate basis unless one is willing to elevate nearly all subfamilies and many tribes to family status. This may eventually be justifiable, but at the present time it seems too radical to be acceptable.

ABSTRACT—The following features should be found in a good classification catalog: All species and infraspecific taxa are listed and arranged by senior synonyms, with complete citations to original descriptions and the location of the types noted. Citations are given for synonymizations, generic and specific. Type species of genera are cited, including those improperly designated, and the method for designation. Taxa are arranged according to an acceptable classification scheme, giving citations to the arrangement followed (new classifications must be documented either in the catalog or elsewhere with citations given). Indication of the geographical range covered, and citations to the source of the geographical distribution information is listed. The bibliographic scope of the catalog, with references to search resources examined, is provided. References to identification keys, useful revisions or reviews, and subsequent descriptions are cited. If the list is selective, an indication of the extent of the omissions should be given. Finally, biological notes are included.

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(3.0022)

Bionomics of *Merobruchus julianus* (Coleoptera: Bruchidae)

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From 24 June to 4 September 1969 seed samples of *Acacia greggii* Gray were collected in Yavapai County, Arizona, at Black Canyon City, the mouth of Sycamore Canyon, and from four to ten miles south of Camp Verde. The seed beetles *Merobruchus julianus* (Horn) and *Stator limbatus* (Horn) were reared from seeds from all three localities. Observations on the bionomics of both species were recorded during the study and those of *M. julianus* are reported upon here.

Reports of *M. julianus* infesting *A. greggii* have only recently been published (Johnson, 1968) and an earlier host record clarified (Bottimer, 1969). Johnson published information concerning the bionomics of *M. julianus* after it was found infesting *Acacia berlandieri* Bentham. His observations will be compared to our observations of *M. julianus* infesting *A. greggii*.

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EGGS AND OVIPOSITION

Eggs of *M. julianus* are about 0.55 mm. long and 0.24 mm. wide and are unlike eggs of any other species of bruchid that we have observed in that the anchoring glue is not spread out evenly. An egg is apparently systematically tacked down with the glue-like "anchoring ropes" or filaments radiating from and encircling the egg (fig. 1). This method of attachment may provide for expansion of the seed pod which probably occurs during the several days required for the embryo's development into a first instar larva. Most eggs of *M. julianus* drop off as the green pods expand.

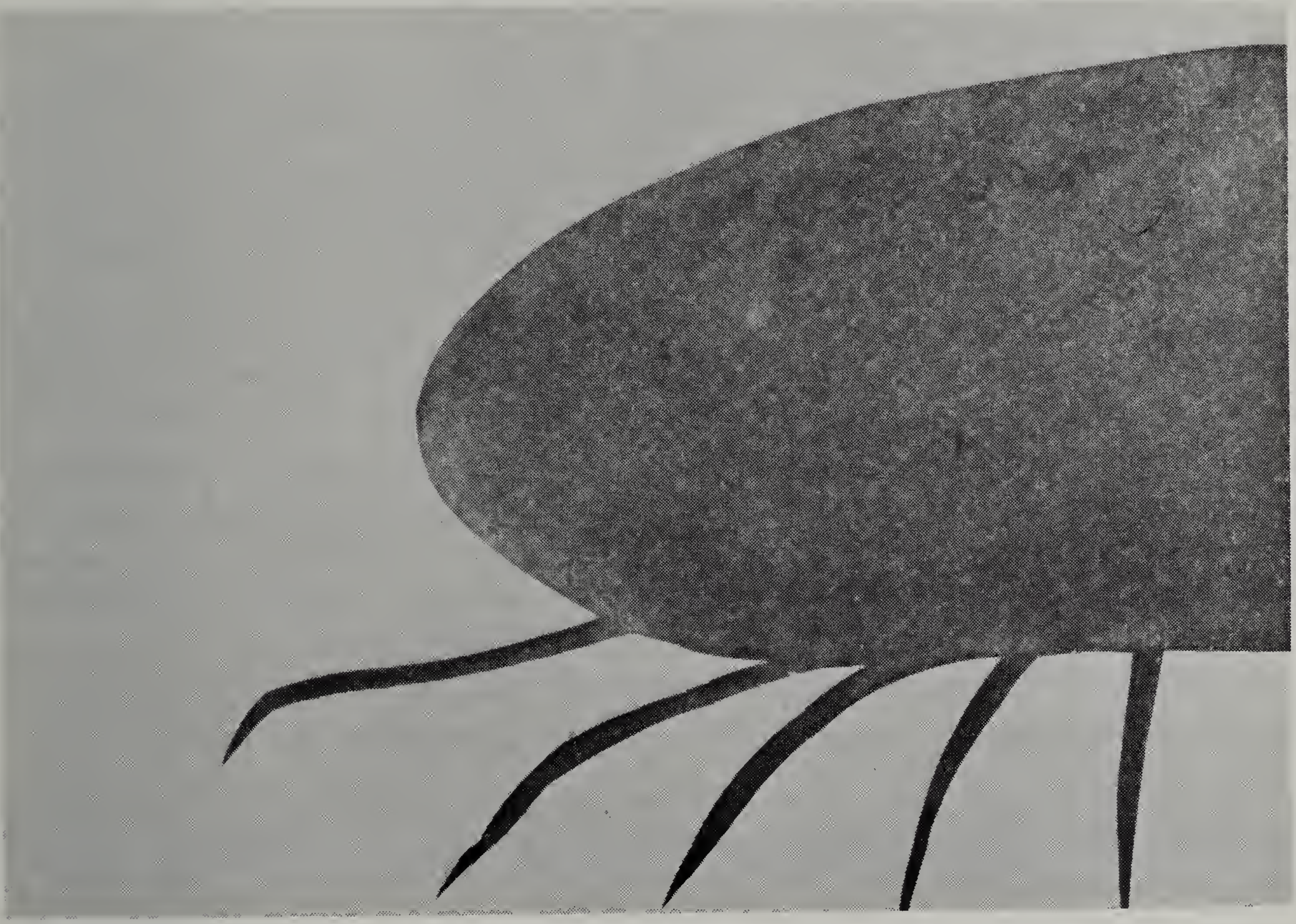

Fig. 1. Posterior portion of an egg of *M. julianus* showing filaments which provide for attachment of the egg. X 280

Although Johnson found no eggs of *M. julianus* on seeds or pods of *A. berlandieri,* he postulated that oviposition probably occurs when the pods are immature. We also were not able to observe oviposition, but we did find many eggs of *M. julianus* on immature seed pods of *A. greggii* collected 24 June, and an identical egg on a mature but still somewhat green seed pod collected 24 July. Only the empty egg chorions of eggs which were laid on nearly mature but still green pods remained on the pods and thus allowed us to associate them with the adult bruchids. The tissues of these pods apparently did not expand enough to slough off the eggs. No empty egg chorions were found on the pod surfaces whose seeds revealed evidence of early entry into them by bruchid larvae. It is assumed that the above is also true of *M. julianus* when it attacks the seeds of *A. berlandieri.* All entry holes in the seeds made by first instar larvae were at least partially healed over, including entry holes in seeds collected late in the summer. This seems to substantiate Johnson's theory that oviposition occurs only on green seed pods.

Another reason for suspecting that eggs are laid only on green pods is that there was no second generation reared from the laboratory cultures. In the field it is probable that no more than one generation occurs per year because of the lack of green pods. The adults probably overwinter.

Eggs are always laid at the edges of the bulges in the pod made by the developing seeds but near the center of the valve on very immature seed pods and near the edge on relatively mature but still green pods.

LARVAE

The first instar larvae burrow out of the underside of the egg and enter the seed pod almost directly. There is a slight space between the egg and the pod and consequently they have not been observed to push frass into the empty egg chorions as do many other first instar bruchid larvae.

Johnson (1968) found that the larvae of *M. julianus* would sometimes consume more than one seed of *A. berlandieri.* We found that even though the seeds of *A. greggii* were sometimes as small as 6 mm. in diameter, a larva of *M. julianus* never consumed more than one seed. Possibly this phenomenon is because the seeds are separated by pod constrictions in *A. greggii* but apparently either touch or almost touch in *A. berlandieri.* The seeds of *A. berlandieri* are usually larger than those of *A. greggii* and, apparently as a result of this and the observation that *M. julianus* larvae may feed on more than one seed during the course of their development, the specimens of *M. julianus* reared from seeds of *A. berlandieri* are larger in size.

In the laboratory, especially with those seeds isolated in gelatin capsules, the larvae sometimes exited from seeds through what would become the adult emergence hole and then died. A possible reason for the abnormal behavior may have been the disturbance when the cultures were examined every two or three days.

Johnson noted that *A. berlandieri* seeds were glued to the inner wall of the pod valve, apparently by the larvae, and remained attached to the pod valve long after the adult bruchid had emerged. Although a glue-like substance was sometimes present on the pods and seeds of *A. greggii,* there was never enough to make the attachment of the seeds to the pod valves lasting. Possibly differences in the composition of the seeds enables the larvae, in the seeds of *A. berlandieri,* to produce more glue-like substance.

ADULTS

Adults of *M. julianus* usually emerge through holes burrowed directly from seeds through the valves of the pods apparently because the pods are indehiscent or tardily dehiscent. Johnson also noticed this habit of *M. julianus* when it exited from seeds of *A. berlandieri.* This is of interest because these pods were dehiscent and there is no apparent advantage to the insect in leaving the seed in this manner. It is possible that some *A. berlandieri* pods are tardily dehiscent like those of *A. greggii,* and the behavior of the bruchids is a necessity as it is with other bruchids infesting indehiscent pods.

The maximum time recorded for development from egg to adult for *M. julianus* was 60 days. More accurate information may be difficult to obtain since the adults apparently do not lay eggs on dry seed pods and may not mate under laboratory conditions.

The percentage of seeds destroyed was 4.6 from the Camp Verde area, 2.5 at Black Canyon City, and 0.7 at the mouth of Sycamore Canyon. The relatively low percentage of seeds destroyed indicates that these insects probably have a very minor effect on the reproduction of these plants.

Many *Eupelmus cushmani* (Crawford) and *Urosigalphis bruchi* Crawford, hymenopterous parasites of the immature stages of *M. julianus,* were reared from seeds collected at the Camp Verde and Sycamore Canyon sites. Parasites were reared from eggs of *M. julianus* collected at all three locations.

ACKNOWLEDGMENTS

The Hymenoptera collected during this study were identified by P.M. Marsh and B.D. Burks of the Entomology Research Division, Agricultural Research Service, U. S. Department of Agriculture. Financial assistance for this study was provided by the same organization under Grant 12-14-100-9187 (33).

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JOHNSON, C. D. 1968. Notes on the systematics, host plants, and bionomics of the bruchid genera *Merobruchus* and *Stator* (Coleoptera: Bruchidae). Pan-Pac. Entomol. (1967), 43 (4): 264-271.

ABSTRACT—Bionomics of *Merobruchus julianus* (Coleoptera: Bruchidae) Glen W. Forister and Clarence D. Johnson. Bionomics of *Merobruchus julianus.* A unique method of attachment of bruchid eggs to immature seed pods was observed when *Merobruchus julianus* attack the seeds of *Acacia greggii.* The eggs are attached by thin filaments which apparently allow the egg to remain in position while the growing pod expands. In addition, it was observed that adult females oviposit only on immature seed pods; a period of about 60 days is necessary for development of *M. julianus* from egg to adult; these bruchids destroy from 0.7% to 4.6% of the seeds of *A. greggii;* and the hymenopterans *Eupelmus cushmani* and *Urosigalphus bruchi* parasitize the immature stages of *M. julianus.* When compared to an earlier report of the bionomics of this bruchid species attacking the seeds of *Acacia berlandieri,* it was found that the habits differ in that a single larva of *M. julianus* is known to destroy only a single seed; the larvae produce little, if any, glue-like substance; and a smaller adult size is reached when they develop in the seeds of *A. greggii.*

DESCRIPTORS: Coleoptera; Bruchidae; Bionomics.

(3.0018)

Isomira Mulsant in America North of Mexico (Coleoptera: Alleculidae): Species of Eastern North America Concluded

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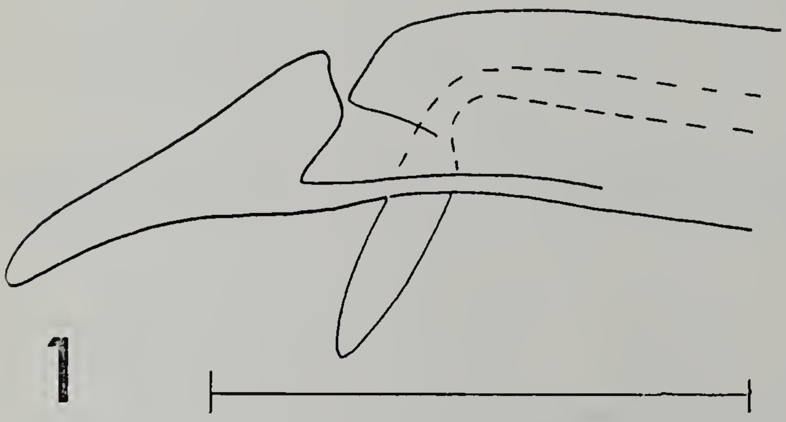
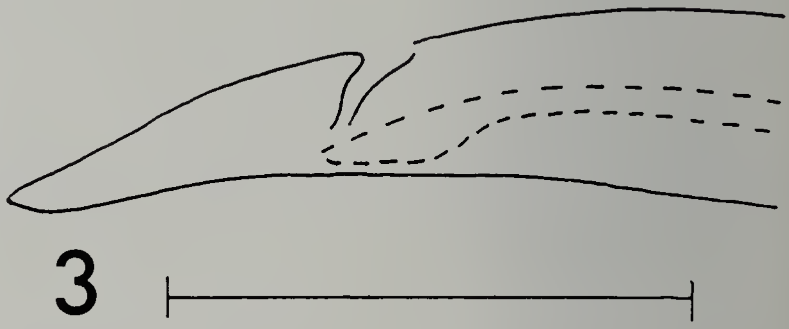
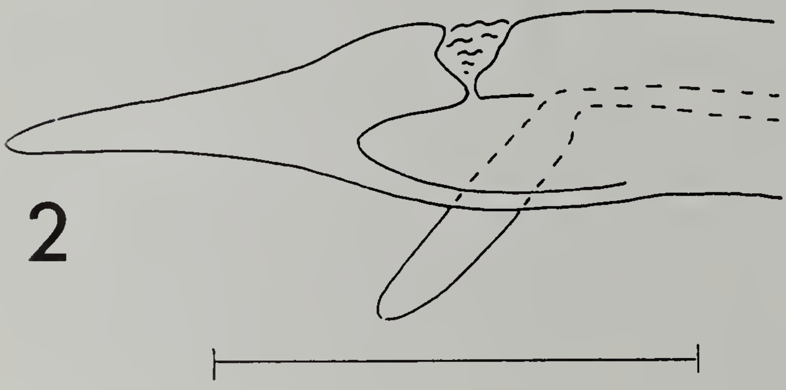
This is a part of my continuing revisionary series the scope of which is defined by the general foretitle, "*Isomira* Mulsant in America North of Mexico (Coleoptera, Alleculidae)." At the time of this writing three parts are in press and another is in preparation. The final part will be a concise synopsis containing short species summaries, tables, distribution maps, a fully illustrated key, and a definition of the genus.

The present contribution is concerned with redescriptions, taxonomic notes and distributional data for the *Isomira* species of eastern North America not treated in an earlier part (Marshall, 1970). For the purpose of making this paper as generally useful as possible, I have included a key to the species of eastern North America.

Terminology is in general accordance with that of Campbell (1966, 1968). Figs. 1-4 represent lateral views of the male genitalia; the entire apical piece







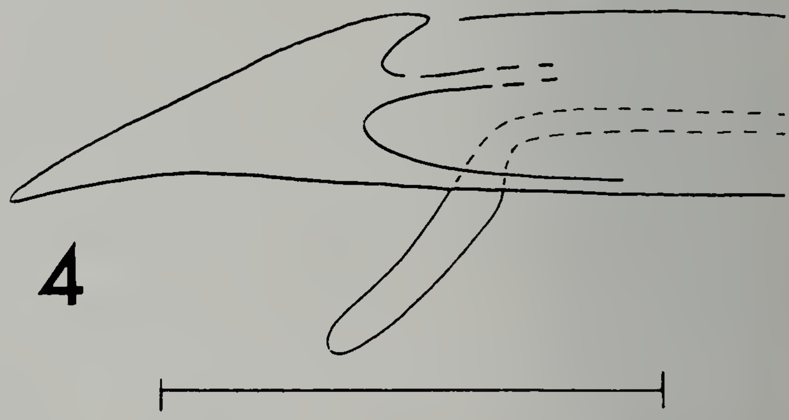


Fig. 1. Lateral view of male genitalia of *Isomira oblongula* Casey.
Fig. 2. Lateral view of male genitalia of *Isomira quadristriata* Couper.
Fig. 3. Lateral view of male genitalia of *Isomira ruficollis* Hamilton.
Fig. 4. Lateral view of male genitalia of *Isomira iowensis* Casey.

is shown, but only the distal portion of the basal piece is illustrated. Size of the eyes is expressed as the ocular index after Campbell and Marshall (1964). The label data of specimens examined are summarized for each locality and presented in the following order: locality; month; number of specimens. Seasonal distribution is given as earliest and latest dates on specimen labels.

Key to Eastern North American Species of *Isomira*

1. Third antennal segment two-thirds as long as fourth .... **oblongula** Casey
   Third antennal segment as long as fourth 2

2. Size moderately large, robust (over 8.5 mm. long), strongly convex in cross-section; Atlantic and Gulf Coast states and northward through midwestern states to Wabash Valley in southwest Indiana 3
   Size smaller, not robust (less than 8.5 mm. long); feebly or moderately convex in cross-section 5

3. Ocular Index less than 34 .... **valida** Schwarz, males
   Ocular Index greater than 34 4

4. Sides of elytra subparallel on basal two-thirds; angle formed at junction of inner and basal sides of terminal segment of maxillary palpi only slightly obtuse; inner side three-fourths as long as outer side; known only from Texas .... **texana** Casey
   Sides of elytra broadly rounded for entire length; angle formed at junction of inner and basal sides of terminal segment of maxillary palpi strongly obtuse; inner side one-half as long as outer side; Atlantic and Gulf Coast states northward through midwestern states to Wabash Valley in southwestern Indiana .... **valida** Schwarz, females

5. Ocular Index less than 44 .... **iowensis** Casey, males
   Ocular Index greater than 44 6

6. Ocular Index less than 55 7
   Ocular Index greater than 55 8

7. Eyes prominent; head narrowed suddenly at clypeus, sides of clypeus parallel throughout; color usually brown .... **iowensis** Casey, females
   Eyes not particularly prominent; clypeus tapering gradually to labrum; color usually yellowish .... **sericea** Say

8. Last segment of maxillary palpi slender, angle formed at junction of inner and basal sides obtuse, inner side one-half as long as outer side .... **pulla** Melsheimer
   Last segment of maxillary palpi robust, angle formed at junction of inner and basal sides about 90°, inner side and outer side equal in length, or with inner side slightly longer than outer side 9

9. Head and elytra shining black; pronotum ferruginous .... **ruficollis** Hamilton
   Color combination never as above .... **quadristriata** Couper

Isomira oblongula Casey

Isomira oblongula Casey 1891:51.—Blatchley 1910:1278.

DIAGNOSIS.—This species is the only species of *Isomira* in which the third antennal segment is shorter than the fourth.

DESCRIPTION.—*General:* Oblongate, subparallel; integument shining, densely and minutely punctate throughout; pubescense pale, short, dense and appressed; color piceous brown throughout. *Head:* With terminal segment of maxillary palpi robust, in the general form of a right triangle, the angle formed at the junction of inner and basal sides only slightly obtuse; antennae filiform, slightly more than one-half length of body; third segment two-thirds as long as fourth, remaining segments long and slender, two times as long as greatest width; eyes large, ocular index: $\bar{x}$ (males) = 30.9 $\bar{x}$ (females) = 41.7. *Thorax:* Feebly impressed longitudinally on midline near base; one-and-three-fourths as wide as long, sides straight on basal two-thirds, becoming strongly arcuate to cephalic margin which is subtruncate and two-thirds as wide as the broadly and feebly sinuate caudal margin; basal foveae widely separated and distinctly impressed; basal angles right angles. *Elytra:* Slightly wider at base than pronotum; more than four times as long as pronotum and two times as long as their own greatest width; elytral striae very faintly impressed; intervals flattened basally, gradually and very feebly convex posteriorly, becoming clearly convex apically. *Abdomen:* Polished throughout. *Length:* 5.9 to 8.3 mm.

Male genitalia: Fig. 1.

Location of type: United States National Museum.

Type locality: Buffalo, New York.

Seasonal and Geographic Distribution: 50 male and 161 female specimens were examined; label data established a seasonal distribution from April 6 to July 19, and the following geographic distribution: CANADA: *Ontario:* Ottawa, no date, 1; Point Pelee, June, 10; Ridgeway, July, 1; Turkey Pt., June-July, 8. UNITED STATES: *Florida:* Torreya State Park, May, 2. *Illinois:* Mason Co., Mason State For., May, 2. *Michigan:* Whitmore Lake, June, 2. *New York:* Buffalo, no date, 1; Olcott, June-July, 61. *North Carolina:* Highlands, Wilson's Gap, May, 1. *Ohio:* E. Liverpool, no date, 1; Hocking Co., May, 1. *Pennsylvania:* Allegheny Co., no date, 1. Jeannette, May-June, 9. *South Carolina:* Clemson Coll., June, 1. *Texas:* Bastrop State Park, April, 10.

Discussion.—Variation in this species is not great in most features. The specimens from Florida and Texas are, in general, darker than most northeastern ones, but occasional examples are taken in the northern part of the range that are as dark as the southern ones. The observed variation in the ocular index is 25.5 to 35.5 for males and 36.5 to 45.0 for females.

The robust right-angled form of the last segment of the maxillary palpi is similar to that found in *quadristriata* and *ruficollis,* but the large eyes of *oblongula* (ocular index of 45.0 or less), as opposed to the small eyes of the former two species (ocular index at least 54.0), will distinguish them.

Isomira quadristriata Couper

Cistela quadristriata Couper 1865:62.

Isomira quadristriata, Leconte 1866:139.—Casey 1891:149.—Blatchley 1910:1278.—Papp 1956:148.

Isomira velutina Leconte 1866:139.

Diagnosis.—The combination of the small eyes (ocular index 55 or more), the brown color, and the robust terminal segment of the maxillary palpi with the angle formed at the junction of the inner and basal sides almost 90° serves to separate this common eastern species from its relatives.

Description.—*General:* Body broadly oval in outline, moderately convex in cross-section; color brown throughout; integument shining; pubescence extremely short, dense, and recumbent. *Head:* Moderately and closely punctate; terminal segment of maxillary palpi elongate-robust, outer side curved from apical one-third to tip, angle formed at junction of inner and basal sides almost 90°; antennae about one-half length of body, third segment elongate and equal in length to fourth, remaining segments long and slender, two times as long as greatest width; eyes small, ocular index: $\bar{x}$ = 59.9. *Thorax:* Finely and densely punctate; one-and-three-fourths as wide as long, sides almost straight and feebly divergent on basal two-thirds, becoming more rounded and strongly convergent toward the cephalic margin, the latter truncate and two-thirds as wide as the caudal margin; caudal margin sinuate; basal angles slightly obtuse. *Elytra:* Plainly but sparsely punctate; slightly wider at base than caudal margin of pronotum; four times as long as pronotum and not quite twice (7:4) as long as their greatest width; discal striae, for the most part, not noticeably impressed, sutural striae strongly impressed posteriorly. *Abdomen:* Finely and sparsely punctate; polished throughout. *Length:* 5.5 to 7.8 mm.

Male genitalia: Fig. 2.

Location of type: *quadristriata,* presumably no longer in existence; neotype not designated; *velutina,* Museum of Comparative Zoology.

Type locality: *quadristriata,* "Quebec"; *velutina,* "New York."

Seasonal and Geographic Distribution: An examination of 318 males, 552 females, and 202 the sex of which was not determined established a seasonal distribution of April 29 to August 25 from the following localities: CANADA: *Manitoba:* Aweme, June-July, 3; Ninette, July, 2; 5 mi. SW Shilo, July, 1; Winnipeg, June, 1. *New Brunswick:* Province label only, 1; Bathurst, July, 1; Boiestown, July, 7; Tabusintac, Aug., 2. *Nova Scotia:* Annapolis Royal, July, 2; Kentville, July, 1; Petite Riviere, July, 1; Pictou, July, 1; Truro, July, 2. *Ontario:* Province label only, 10; Bancroft, July, 1; Bells Corners, July, 1; Bruce Lake, Aug., 1; Burk's Falls, July, 2; Campden, June, 2; Carleton Pl., July, 1; Chatterton, July, 4; Constance Bay, June, 1; Galetta, June, 1; Hastings, June, 1; Kearney, July, 3; Leamington, June, 3; Little Current, July, 1; Malachi, July, 2; Marmora, June, 4; Muskoka, July, 2; Noadicies, no date, 1; Normandale, June, 2; Orrville, June, 1; North Bay, July, 1; Orillia, June, 1; Ottawa, June, 2; Parry Sound, July, 1; Point Pelee, no date, 1; Port Credit, July 2; Prince Edward Co., June-July, 29; Ridgeway, June, 2; Scotia Jct., July, 1; Six Nations, Brant, Oct., 1; Sudbury, no date, 2; Timmins, no date, 1; Toronto, June-Aug., 3; Vineland, June, 2. *Quebec:* Province label only, 2; Aylmer, Quenn's Park, June, 14; Brome, May, 1; Covey Hill, June-July, 9; Duparquet, July, 32; Fort Colonge, July, 6; Knowlton, June-July, 25; Mt. Albert, July, 1; Megantic, July, 1; Montefort, Laurentian Mts., June, 1; Montreal, June, 1; Old Chelsea, July, 1; Parke Reserve, Aug., 1; Perkins' Mills, June, 3; Potton Springs, June-July, 2; St. Hilaire, June, 1; Wakefield, June-July, 4. UNITED STATES: *Connecticut:* Litchfield, June, 4; Short Beach, no date, 3; Stamford, June, 2. *Florida:* State label only, 2. *Georgia:* Cloudland Canyon State Park, May, 1. *Illinois:* State label only, 3; Apple River State Park, June, 1; Ogle Co., White Pines State Park, June, 1. *Maine:* State label only, 1; Cumberland Co., June, 3; Kineo, June, 1; Lincoln Co., June-Aug., 9; Linekin, Aug., 1; Machias, June, 1; Monmouth, June, 1; Mr. Katabdin, Camp Kennedy, Aug., 1; Orono, July, 3; Passadumkeag, July, 5; Southport, July, 1; Staceyville, Aug., 1. *Maryland:* State label only, 8; Jackson's Island, May, 1; Plummers Island, May, 1. *Massachusetts:* State label only, 17; Beach Bluff, July, 2; Boston, June-Aug., 5; Dorchester, May, 1; Hopkinton, May, 1; Humarock, June, 1; Marion, June, 1; Mt. Wachusett, no date, 1; W. Summit, N. Adams, July, 1; North Saugus, June, 6; Mt. 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McIntyre, June, 5; New York, no date, 1; Niagara Falls, June, 1; Olcott, 19; Oliverea, June-July, 3; Peru, June, 11; Petersburg, June, 2; Putnam Co., June, 9; Ramapo, May, 1; Redford, June, 11; Rochester, June, 1; Salem, June, 1; Upper Saranac, July, 12; Tompkins Co., Malloryville, June, McLean Bogs, June-July, 18; Ulster Co., Catskill Mts., July, Lake Mohawk, June, Slide Mtn., June, 14; W. Hebron, June, 6; West Point, May-June, 20; White Lake, July, 1; Whiteface Mt., June-July, 36; Whitehall, May-June, 4; Wilmington, June, 11. *North Carolina:* Balsam, June, 5; Black Mts., May-Aug., 104; Cherokee, May, 2; Doughton Pk., June, 6; Graybeard Mt., May-June, 47; Highlands, Whitesides Mtn., no date, 2; Mt. Mitchell, June, 4; Retreat, June, 2. *Ohio:* Clifton, May-June, 4; Geneva, no date, 1; Greene Co., May, 4; Hocking Co., May-June, 3. *Pennsylvania:* State label only, 6; Allegheny, no date, 1; Canadensis, June-July, 3; Cresson, July, 2; Crisp, July, 1; Dauphin, June, 1; Glenolden, June, 1; Hunter's Run, June, 1; Jeannette, June, 8; Monroe Co., July, 3; Montgomery Co., July, 1; Philadelphia, June, 2; Pittsburg, July, 3; Water Gap, no date, 1. *Rhode Island:* Watch Hill, June, 2. *Tennessee:* Great Smokey Mts., July, 2; Indian Gap, May-June, 2. *Virginia:* State label only, 1; Mt. Elliot, June, 46; Penington Gap, June-July, 2; Tazewell, June, 1. *West Virginia:* Cheat Mts., June, 1. *Wisconsin:* State label only, 20; Bayfield, no date, 14; Beaver Dam, no date, 1; Milwaukee Co., no date, 1; Polk Co., July, 1.

DISCUSSION.—The variation is considerable. Color varies from light brown to dark piceous brown. Usually the darker color is confined to the head (which in many cases is almost black) and the pronotum, but occasionally specimens are found in which the body is entirely of a very dark piceous color. Even more rarely the body is wholly light brown. The labrum and the clypeolabral junction are usually conspicuously lighter in color than the remainder of the head. The ocular index ranges from 55 to 65.

Isomira pulla Melsheimer also has an ocular index of over 55, and the larger examples of that species might be confused with *quadristriata*. The more slender terminal segment of the maxillary palpi of the former with the angle at the junction of the inner and basal sides obtuse is quite distinct from the right-angled condition of that segment in *quadristriata*. Another eastern species, *ruficollis* Hamilton, also has a comparable ocular index range, but is distinguished by the coloration as given in the key.

The male genitalia, in lateral view, have a pronounced dorsal swelling on the basal one-third of the apical piece, which is narrowed suddenly beyond the swelling and tapered to a point (Fig. 2).

Isomira ruficollis **Hamilton**

Isomira ruficollis Hamilton 1893:308.—Blatchley 1910:1277.

DIAGNOSIS.—This eastern species is readily recognized by the distinctive coloration; the elytra are shining black, prothorax ferruginous, the head shining black except for the labrum and clypeolabral junction which are also ferruginous but slightly darker in color than the prothorax. Only one other North American alleculid, *Isomira variabilis* Horn from California, has this coloration.

DESCRIPTION.—*General:* Body broadly oval in outline, moderately convex in cross-section; elytra black; prothorax ferruginous; head black, with labrum and clypeolabral junction dark ferruginous; integument punctate, shining throughout; pubescence moderately dense. *Head:* Moderately and closely punctate; pubescense short and appressed; terminal segment of maxillary palpi robust, outer side curved from apical one-third to tip, angle formed at junction of inner and basal sides slightly acute; antennae about one-half length of body, third segment subequal in length to that of fourth, segments five through seven long and slender, eight through eleven becoming shorter and stouter; eyes small, ocular index: $\bar{x} = 59.5$. *Thorax:* Moderately and closely punctate; one-and-one-half times as wide as long; sides almost straight and weakly divergent on basal two-thirds, becoming more rounded and strongly convergent toward cephalic margin; cephalic margin truncate, two-thirds as wide as the caudal margin; caudal margin feebly and broadly sinuate; basal angles slightly obtuse; pubescence short and appressed. *Elytra:* With punctation evident but sparse; bases slightly wider than pronotum; one-and-one-half times as long as their greatest width; discal striae not visibly impressed; sutural striae lightly impressed basally, becoming conspicuously impressed on apical one-third; pubescence moderately long and semi-erect. *Abdomen:* Finely and sparsely punctate; pubescence short, moderately dense and appressed; anterior sterna very dark, piceous brown, posterior ones lighter, fifth brown. *Length:* 5.8 to 7.8 mm.

Male genitalia: Fig. 3.

Location of type: Carnegie Museum.

Type locality: Near Allegheny, Pennsylvania.

Seasonal and Geographic Distribution: Study of 22 males and 80 females established a seasonal distribution of May 10 to June 20 from the following localities: UNITED STATES: *Kentucky:* Frankfort, June, 6. *Ohio:* Clifton, June, 3; Delaware Gap, May, 1; Greene Co., May-June, 19; Highland Co., June, 3; Hocking Co., May-June, 3; Sciota Co., June, 1. *Pennsylvania:* Allegheny Co., June, 16; Jeannette, May-June, 44; Pittsburg, no date, 6.

Discussion.—Color variation in non-teneral adults is practically non-existent. In teneral specimens the normally shining black elytra are dark brown, but the characteristic reddish pronotum is present. The ocular indices of specimens measured varied from 56.0 to 63.0.

A unique morphological feature of *ruficollis* is the acute angle formed at the junction of the inner and basal sides of the last segment of the maxillary palpi.

***Isomira iowensis* Casey**

Isomira iowensis Casey 1891:145.

Diagnosis.—The males of this species are readily distinguished by the combination of the large eyes (ocular index 44 or less), third and fourth antennal segments equal in length, and the small size (8 mm. or less).

The species that is most likely to be confused with this one is *sericea,* particularly the females. The yellowish color that is typical of *sericea* Say is usually sufficient to distinguish these species, but yellowish-brown specimens of *sericea* are frequently taken and are extremely difficult to distinguish from *iowensis* on the basis of color alone. The males are readily separable from both sexes of *sericea* by the larger eyes. A subtle but apparently constant character for separating the females of *iowensis* from *sericea* is the parallel-sided condition of the head in front of the eyes in the former and the slightly tapering form in the case of the latter species.

Description of Male.—*General:* Elongate-oval, somewhat convex, feebly shining, brown throughout; pubescence fine, short, and subrecumbent. *Head:* In dorsal view narrowed suddenly in front of eyes; clypeus parallel-sided to labrum; mandibles hidden from above; minutely and moderately punctate throughout; terminal segment of maxillary palpi in the general shape of an obtuse triangle; not quite one-half as wide as long, angle formed at junction of inner and basal sides very obtuse, the inner side only half as long as the outer side; antennae one-half as long as body, third segment as long as fourth; segments four through ten gradually expanded and rounded to apices on outer side, distal width of each of these segments slightly more than one-half of segment; eyes moderately large, ocular index: $\bar{x} = 40.8$. *Thorax:* One-and-one-third as wide as long; sides straight on basal two-thirds, becoming strongly rounded toward cephalic margin; cephalic margin feebly rounded, one-half as wide as caudal margin; basal foveae widely separated, barely discernible; basal angles right angles. *Elytra:* Slightly wider at base than pronotum; three-and-one-half times as long as pronotum and two times longer than their own greatest width; discal striae obsolete; sutural striae impressed and visible for most of their length, becoming more pronounced apically. *Abdomen:* Polished throughout, *Length:* 5.7 to 7.5 mm.

Male genitalia: Fig. 4.

DESCRIPTION OF FEMALE.—In most respects resembling male but differing as follows: (1) antennal segments four through ten elongate and slender, segments less rounded on outer side, not expanded distally, distinctly less than one-half as wide as long; (2) eyes smaller, ocular index: $\bar{x} = 47.2$.

Location of type: United States National Museum.

Type locality: "Iowa."

Seasonal and Geographic Distribution: An examination of 85 males and 86 females established a seasonal distribution of March 5 to June 23 from the following localities: CANADA: *Ontario:* Ridgeway, May, 1. UNITED STATES: *Arkansas:* top Mt. Magazine, May, 1. *Florida:* State label only, 3; Alachua Co., March, 1; Bellair, no date, 3; Branford, March, 1; Crescent City, no date, 1; Dunedin, April, 7; Gainseville, March, 35; Marion, March, 1; Oneco, March, 2; Waccasassa River, Gulf Hammock, March, 4. *Georgia:* Atlanta, April-May, 11; Blood Mtn., May, 1; Decatur, no date, 1; Dunwoody, no date, 13; Mount Berry, May, 1; Prattsburg, April, 1; Rabun Co., Pine Mtn., 1400', June, 1; St. Simon Isl., April-May, 1. *Illinois:* Jackson Co., Giant City State Park, May, 1; Pope Co., Bell Smith Springs, May, 1; Union Co., Pine Hills, May, 1. *Kansas:* State label only, 1; Douglas Co., no date, 1; Onaga, no date, 3; Topeka, no date, 1. *Maryland:* Plummers Island, April-May, 3. *Missouri:* Lake Wappapello, Poplar Bluff, May 6. *North Carolina:* Balsam, June, 5; Franklin, May, 1; Murphy, May, 1. *Ohio:* Ashland Co., May, 1; Delaware Co., April, 1; Greene Co., June, 1; Hocking Co., May, 10; Scioto Co., June, 2; Shawnee Forest, June, 1. *Pennsylvania:* Allegheny Co., no date, 10; Jeannette, May, 12; Pittsburg, June, 1. *South Carolina:* Clemson College, May, 1. *Tennessee:* Knoxville, April, 1; Loretto, May, 2. *Texas:* Bastrop, April, 1; Bastrop St. Pk., April, 5; Cherokee Co., May, 1; College Station, April-May, 2; 15 mi SW of Elkhart, April, 1; Smith Co., April, 3.

DISCUSSION.—The variation occurs mainly in color and eye size, with the color varying from a uniform light brown or tan to a dark, somewhat piceous brown. Often the pronotum is slightly darker than the remainder of the body. The ocular index varies from 37.0 to 43.5 in males and from 43.0 to 51.5 in females.

The moderately large eyes give *iowensis* a general habitus that is quite similar to that of *oblongula* Casey, but the latter species is readily distinguished by the third antennal segment being but two-thirds as long as the fourth. In *iowensis* these segments are equal.

ACKNOWLEDGEMENTS

Thanks are due: T. J. Spilman, United States National Museum, allowed the author access to the Casey material; E. C. Becker, Canadian National Collection, assisted generously in an unsuccessful attempt to locate the Couper type of *quadristriata*.

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3.0018. Isomira Mulsant in America north of Mexico. (Coleoptera: Alleculidae): species of eastern North America concluded.

ABSTRACT—As a part of a continuing revisionary series, four species of *Isomira* of eastern North America are redescribed with pertinent taxonomic notes and distributional data. This paper concludes the species of eastern North America so a key to species known to occur in that geographic area is provided.

DESCRIPTORS: Coleoptera; Alleculidae; *Isomira;* key; eastern U.S.A.

LITERATURE NOTICES

1

Jurassic Insects of Karatai. Edited by B. B. Rodendorf. Division of General Biology, Academy of Sciences of U. S. S. R., Moscow. 252 pp., 25 pls., many text figures. 1968.—Karatai is located in southern Kazakhstan, U. S. S. R. Many new families, genera, and species in 17 orders of fossil insects are described; other previously described taxa are described, discussed, or recorded. The Coleoptera section is divided into four parts. A. G. Ponomarenko wrote the general introduction to the beetles (pp. 114-117) which includes some species in *incertae sedis* status, and he wrote the part on Archostemata (pp. 118-138) which includes the Cupedidae, Ademosynidae (new family), Schizophoridae (new family), and Catiniidae (new family). A. L. Tichomirova wrote the chapter on Staphylinidae (pp. 139-154). L. N. Medvedev wrote the chapter on Chrysomelidae (pp. 155-165). All in all, 62 species of beetles are recorded, with 38 of them being new, in 36 genera, with 21 of those being new. The article is written in the Russian language.

2

Historical Evolution of the Coleoptera-Archostemata. By A. G. Ponomarenko. Transactions of the Paleontological Institute, Academy of Sciences of the U. S. S. R., vol. 125, 239 pp., 14 pls., 122 text figures, 1969.—Most of this work is devoted to descriptions, keys, and illustrations of the suborder Archostemata. Many new taxa are described, even a new family. There are keys to all families and genera and to many species. The classification of the group is discussed at length, and a large section is devoted to phylogeny. The following families are included in the Archostemata: Tshekardocoleidae, Permocupedidae, Cupedidae, Taldycupedidae, Ademosynidae, Asiocoleidae, Tricoleidae (new family), Rhombocoleidae, Schizophoridae, Catiniidae, and Micromalthidae. The Cupedidae contains both fossil and extant beetles; the Micromalthidae contains one extant species only. All other families are strictly fossil. This extensive work is written in the Russian language.

■■■

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BUPRESTIDAE: Will exchange specimens and determine *Chrysobothris* from southwestern U.S.A. Jerry Davidson, Dept. of Entomology, Oregon State University, Corvallis, Oregon 97331.

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SCARABAEIDAE: Limited number of *Pleocoma badia* available. Terry W. Taylor, 8529 Norwood Pl., Rosemead, CA 91770.

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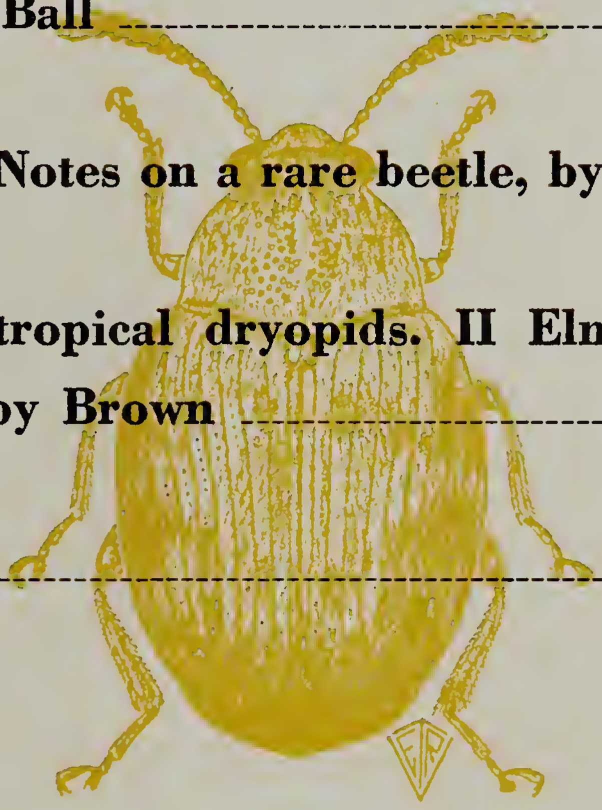

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The Species of the Mexican Genus *Aztecarpalus*, New Genus (Coleoptera: Carabidae: Harpalini).[1]

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The Tribe Harpalini is represented in Mexico by a varied lot of species, most of which are members of wide-ranging genera. In the course of reviewing the taxonomy of the Mexican harpalines, I came upon a small, rather well circumscribed group of species the members of which resembled in appearance members of the genus *Anisotarsus,* subtribe Anisodactylina. The resemblance was so marked, in fact, that I did not realize the beetles belonged to the subtribe Harpalina until I examined them with a microscope. Several of these species had been previously described and assigned to *Harpalus* or *Anisotarsus.* I thought they could be assigned to the genus *Trichotichnus,* but detailed study exposed a multitude of differences between the Mexican species and the members of *Trichotichnus,* especially the North American members. Should the Mexican group be assigned to *Trichotichnus* or not? The title answers this question, and reasons for the decision are presented below.

The Mexican species of this group are themselves a varied lot. Regrettably, the specimens available were too few to conduct a detailed analysis of relationships. However, it seemed clear that a number of species were represented, and study of relevant type material revealed that three of the species were undescribed.

In this paper, all known taxa are described and illustrations of diagnostic characteristics are provided. Brief notice is given to evolutionary implications inherent in the geographical distribution and morphology of the relevant taxa.

This is my initial essay on the Harpalini of Mexico. Subsequently, I hope to treat all of the harpaline species of that country.

ACKNOWLEDGMENTS

For the loan of type material, I wish to thank R. D. Pope and R. B. Madge, British Museum (Natural History), London, England; and R. Gordon and P. J. Spangler, United States National Museum, Washington, D. C.

P. J. Darlington, Jr., Museum of Comparative Zoology, Cambridge, Massachusetts, provided me with specimens of various palaearctic Harpalini to compare with the Mexican material.

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For hospitality extended to me during my visit to the Museum National d'Histoire Naturelle, Paris, I take pleasure in thanking A. Bons and J. Negre.

Technical assistance was received from J. C. Shore, M. Wilkie, and J. S. Scott. My colleagues B. S. Heming, B. Hocking, and D. R. Whitehead read and criticized preliminary versions of the manuscript on which this paper is based.

MATERIALS

This study is based on 96 specimens of the genus *Aztecarpalus,* including type material, specimens collected by D. R. Whitehead and myself, and by L. W. Swan.

Because the previously known specimens of this group were placed in *Harpalus* or *Anisotarsus,* I have studied the type material of all known Mexican species of these genera, and am reasonably confident, therefore, that the three species described here as new have not been previously described.

Additional material examined consisted of a few representatives of various groups related to *Aztecarpalus:* the North American *Trichotichnus dichrous* Dejean and *vulpeculus* Say, and the Palaearctic *T. longitarsis* Morawitz (type species of the genus); *Parophonus maculicornis* Duftschmid; *Coleolissus biseriatus* Lesne; *Ophoniscus* species (?); and *Hyparpalus tomentosus* Dejean.

Locality data are recorded for the specimens examined. The following abbreviations are used to indicate the museums in which the material is housed:

BMNH — British Museum (Natural History), London, England.
CAS — California Academy of Sciences, San Francisco, California.
MCZ — Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.
MHNP — Museum National d'Histoire Naturelle, Paris, France.
UASM — University of Alberta, Strickland Museum, Edmonton, Alberta, Canada.
USNM — United States National Museum, Washington, D. C.

METHODS

Diagnostic characteristics and descriptions. — The characteristics which readily distinguish the members of each species from those of similar species are provided in three keys, based on, respectively, external characteristics, form of the median lobe of the male genitalia, and on details of the internal sac of the male genitalia. The descriptions contain additional details of use in identifying specimens.

Measurements and ratios. — The following measurements were made with an ocular micrometer in a stereoscopic binocular microscope. The length represented by a micrometer scale interval at the magnification 40X was 0.04 mm.

Head length. — straight-line distance from base of mandible to posterior margin of compound eye, on left side of head.

Pronotum length — straight-line distance from apical to basal margin measured along mid-line.

Elytra length — straight-line distance from basal carina to apex of longer elytron.

Total length — the sum of the measurements described above.

Length of antennal scape — maximum linear distance from apex of scape to basal constriction.

Width of second article of male front tarsus — maximum linear transverse distance.

Length of inner (longer) spur of hind tibia — maximum linear distance from base to apex.

Length of articles one (metatarsus), two, and three of hind tarsus — maximum linear distance on dorsal surface, from base to apex of each article.

The following ratios were formed:

Scape-Tarsal Ratio — length of antennal scape/width of second article of male front tarsus. Low values indicate relatively wide tarsal articles.

Scape-Tibial Spur Ratio — length of antennal scape/length of inner spur of hind tibia. Low values indicate relatively long tibial spurs.

Hind Tarsal Ratio — length of articles two plus three/length of metatarsus. Low values indicate a relatively long hind metatarsus.

Illustrations. — Line drawings were prepared with the aid of a camera lucida mounted on a Wild M5 stereoscopic binocular microscope. The photograph illustrating elytral microsculpture of *A. schaefferi* was taken with an ISM U3 Scanning Electron Microscope.

Recognition, grouping and ranking. — The identity of specimens was determined by comparison with type material. Substantial similarity between types and non-typic specimens in details of color, external morphology, and genitalic characteristics was the basis for identification.

The categories used are species, species group, and genus. Because so few specimens are available, it is impossible to be sure that character differences indicate that specimens exhibiting them represent specifically distinct populations. Of seven species recognized, representatives of only three were collected in the same localities. Further, representatives of only four species were found in more than two localities. The sympatric specimens assigned to different species differ in color, form, setation of hind tarsi, and a number of details of the male genitalia. Other groups of specimens judged to be conspecific were regarded as distinct from still other conspecific groups if they differed to a similar degree in several of the same kinds of characteristics as those listed above. The implication of such differences is that the groups so distinguished represent reproductively isolated populations, and as such, are specifically distinct.

Grouping within the genus was based on phylogenetic interpretation of character correlations among species. That is, the groups were based on combinations of structural characters thought the most likely to show phylogenetic relationship. This involves weighting, and the criteria for this activity are ably described by Mayr (1969: 217-228).

For example, specimens of *schaefferi* new name and *trochotrichis* new species are similar in that both bear a puncture in elytral interval 3. Males of *schaefferi* and *marmoreus* new species share a sclerotized bar on the internal sac of the male genitalia, a characteristic not shared with *trochotrichis*. In the possession of long hind wings, specimens of *schaefferi* differ from both *marmoreus* and *trochotrichis*.

Because both the characters elytral setae and wing length are known to vary within many carabid genera, they are not regarded as strongly indicative of relationships as is the possession of the sclerotized bar of the internal sac, a character which seems to be unique in this genus. Thus, in grouping these three species, *schaefferi* and *marmoreus* were placed together, and *trochotrichis* was excluded.

The decision to rank the complex of seven species as a genus is discussed below.

RELATIONSHIPS, RANKING AND CLASSIFICATION OF *Aztecarpalus*

By applying the criteria listed by Mayr (1969: 233) I attempt to demonstrate that *Aztecarpalus* is a group qualifying for generic rank. First, however, it is necessary to marshal evidence bearing on the question of unity of descent, *i.e.* is the group monophyletic? The members of this taxon share a unique combination of structural characteristics drawn from the head, mouthparts, thorax, legs, and male and female genitalia (see Table 1). It seems most unlikely that this complex combination of characters would arise more than once. In addition, the member taxa occupy a relatively small, well circumscribed, and more or less continuous area of the earth's surface. These circumstances seem to me to provide compelling evidence that this group is monophyletic and is therefore a valid taxon.

To what rank should this taxon be assigned? The characteristics of its members are clearly those of the subtribe Harpalina, and more specifically of the genus group Selenophori. Thus, the taxon cannot be ranked above a genus.

To apply ranking criteria properly, one should be familiar with the limits and composition of not only the group to be ranked, but also of related taxa. This taxon is most like the members of *Trichotichnus* Morawitz, a group very broadly defined by Schauberger (Csiki, 1932: 1210) but more narrowly so by Jeannel (1942: 628), Basilewsky (1950: 86), and Antoine (1959: 433). Lindroth (1968: 817) also adopted a restricted definition of this genus when he excluded from it the species *Episcopellus autumnalis* Say. I have examined a few specimens representing the *Trichotichnus* complex, and am inclined to accept the narrower definition of the genus, i.e. to follow those authors who excluded many of the subgenera included by Schauberger.

The members of *Trichotichnus* and those of *Aztecarpalus* differ in 15 recorded characteristics, a gap comparable in size to that which separates other genera of the Selenophori. The amount of structural variation encountered in

TABLE 1.

DIFFERENCES IN CHARACTERISTICS BETWEEN MEMBERS OF *Trichotichnus* AND *Aztecarpalus*.

CHARACTERISTICS	*Trichotichnus*	*Aztecarpalus*
Eyes	large	small
Subgena	narrow	broad
Antenna length	longer, articles of flagellum about three times longer than wide.	shorter, articles of flagellum about twice as long as wide.
Mandibles	longer, more slender left, more curved (Fig. 3)	shorter, broader. left, less curved (Fig. 2)
Glossae		
Length	shorter (Fig. 6)	longer (Fig. 5)
Apical width	greater (Fig. 6)	less (Fig. 5)
Paraglossa width	narrower (Fig. 6)	wider (Fig. 5)
Mentum	shorter (Fig. 6)	longer (Fig. 5)
Pronotum, Base	punctate	impunctate
Prosternum	hairy	glabrous
Apical Spur, Anterior Tibia	slender (Fig. 16)	broad (Figs. 14 and 15)
Hind Wings	present, membrane not pigmented	absent, or membrane pigmented
Metepisternum	longer than wide	longer than wide or length and width subequal
Male, spines of internal sac	single	six or more
Female, vaginal sclerite	absent	present
Valvifer of Ovipositor	apex rather blunt, with three short spines (Fig. 38)	apex sharper, with very short spines (Fig. 37)

Aztecarpalus is comparable to that encompassed by other genera near *Trichotichnus*. Some of the structural characteristics (deplanate body, broad tibial spurs, small eyes) suggest that the members of *Aztecarpalus* occupy an ecological zone (possibly subterranean or in the lower layers of leaf litter) different from that occupied by the members of *Trichotichnus*. The diversity of *Aztecarpalus* is about average for the *Trichotichnus* complex of genera. Thus I think it reasonable to rank *Aztecarpalus* as a genus.

Habu (1968) discusses the classification of the subtribe Harpalina and demonstrates conclusively that some members of *Trichotichnus* (genus-group Selenophori) cannot be distinguished from some members of the genus *Harpalus* (genus-group Harpali) on the basis of the relative length of the hind metatarsus. He concludes that it is inadvisable to segregate as taxa the Selenophori and Harpali. However, it seems to me that, on the average, the two groups can be distinguished by a combination of characteristics: length of hind metatarsus; strial punctures of elytra; microsculpture of elytra; setation of paraglossae; and form of male genitalia and extent of membrane on the dorsal surface of the median lobe. In other words, there are two "clusters" of the relevant taxa. Because the Harpalini are so diverse, I think it desirable to recognize these clusters as semi-formal taxa, thereby rendering the group as a whole a bit more manageable. These genus groups are clearly polythetic. Members of *Aztecarpalus* as well as those of *Trichotichnus* have a majority of characters of Selenophori, so I assign these genera accordingly.

Classification and Descriptions

Aztecarpalus new genus

Harpalus; Bates, 1882: 57 (in part).
Anisotarsus; Bates, 1882: 51 (in part).—van Emden, 1953: 534 (in part).
Asmerinx Tschitscherin, 1900: 363 (in part).
Pteropalus Casey, 1913: 131 (in part).
Trichotichnus; Csiki, 1932: 1210 (in part).—Lindroth, 1968: 817 (in part).

Type Species: *Harpalus hebescens* Bates. Here designated.

The members of this genus are distinguished from members of the nearctic harpaline fauna by the characters presented in Table 1, and in the key, below.

Description.—Total length 6.9-11.7 mm. Body deplanate, dorsal surface impunctate and glabrous, except for usual fixed setae.

Color. Body black, elytra black or metallic blue or green. Antennae, mouthparts, and legs black, infuscated, or rufous.

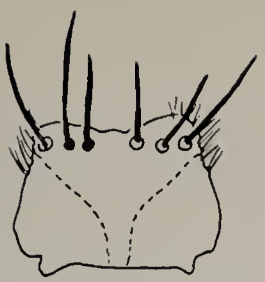
Microsculpture. Labrum, lines coarse, meshes isodiametric to slightly transverse, alveolae beaded. Remainder of dorsal surface with lines fine, meshes isodiametric or slightly to markedly transverse, or lines effaced. Ventral surface with meshes stretched, longitudinally oriented on propleura.

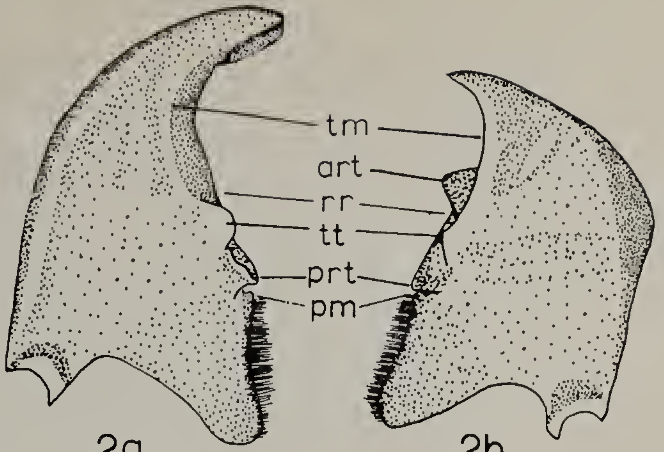
Luster. Subopaque; moderately to strongly shining; iridescent.

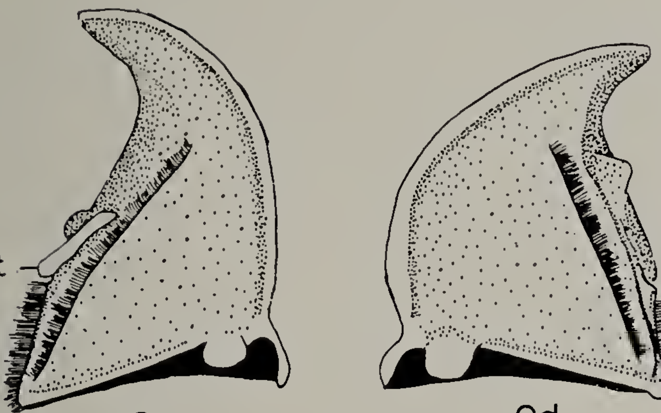
Head. Labrum as in *Trichotichnus* (Fig. 1). Frontal impressions rather broad, prolongations toward eyes feebly developed or absent. Eyes small, subgena at least 1.5 times wider than antennal scape. Antennae short, each extended slightly farther *(lectocolus)*, or no farther than base of pronotum. Mandibles (Fig. 2) short, broad; in closed position, right mandible overlapped by left. Molar region and ventral groove with short hairs. Left mandible (Figs. 2a and c) with cutting edge formed by retinacular ridge; terebral tooth broad, retinacular tooth prominent ridge; premolar tooth small. Right mandible (Figs. 2b and d) with cutting edge formed by terebral ridge; terebral tooth small; anterior retinacular tooth large, prominent; posterior retinacular tooth large; premolar tooth small. (Cf. Figs. 3a, b, c, d). Maxillae each as in *Trichotichnus* (Fig. 4). Labium as in Fig. 5; mentum with prominent lateral lobes, and well developed median tooth. Ligula with glossal sclerite elongate, narrowed toward truncate apex, or rectangular, but not flared apically, with two terminal setae; paraglossae broad glabrous membranous lobes (cf. Fig. 6).

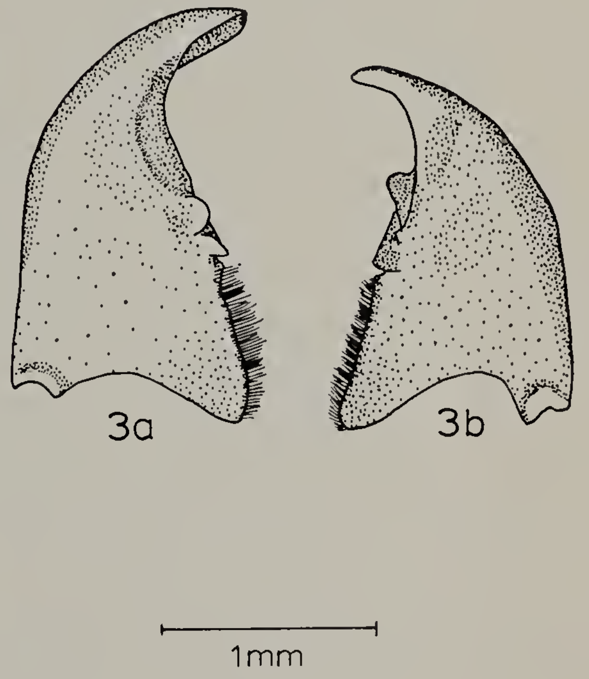
Prothorax. (Figs. 7-13). Pronotum transverse, weakly convex; anterior margin shallowly concave, posterior margin more or less straight; sides rounded, not sinuate posteriorly, or distinctly sinuate; anterior angles broadly rounded; posterior angles broadly to narrowly obtuse, or rectangular. Anterior and posterior transverse impressions present or absent; median longitudinal impression shallow; posterior lateral impressions shallow basins, broadly isolated from narrow lateral grooves. One pair lateral setae, medial in position. Prosternum glabrous except setae at apex of prosternal spine.

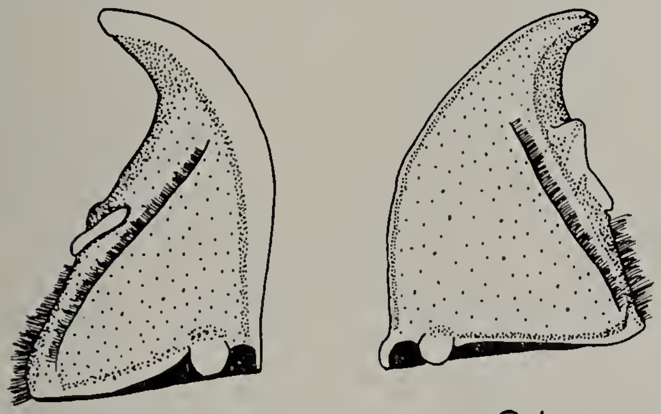
Pterothorax. Metepisternum elongate, with lateral margin longer than anterior margin, or quadrate with lateral and anterior margins subequal in length.

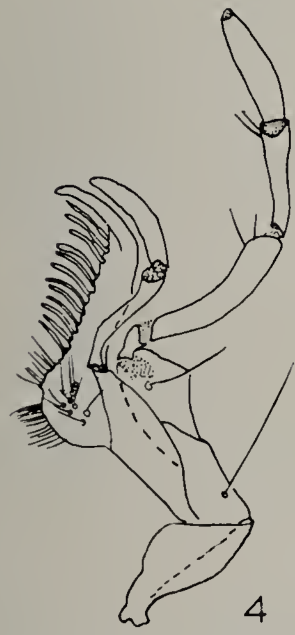


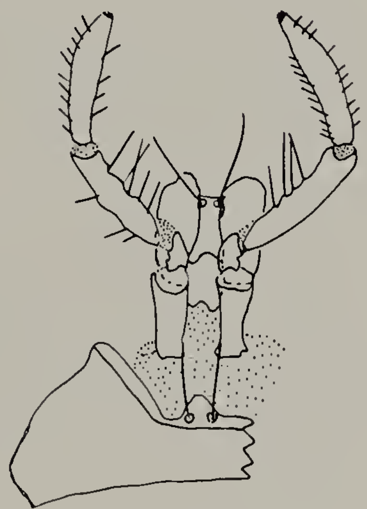












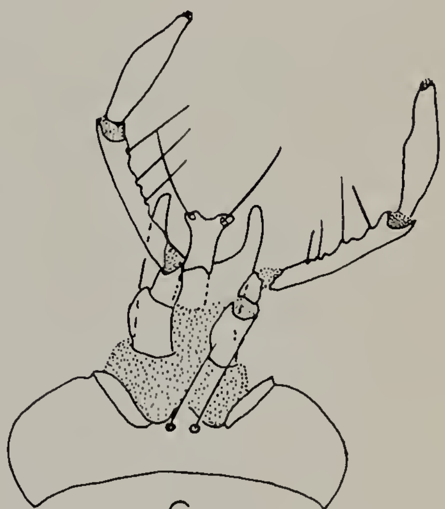


Fig. 1. Labrum, dorsal aspect, of *Trichotichnus longitarsis* Morawitz. Fig. 2. Mandibles of *Aztecarpalus schaefferi* new name

a. Left mandible, dorsal aspect; b. Right mandible, dorsal aspect; c. Left mandible, ventral aspect; d. Right mandible, ventral aspect.

Art-anterior retinacular tooth; pm—premolar tooth; prt—posterior retinacular tooth; rr—retinacular ridge; tm—terebral margin; tt—terebral tooth. Fig. 3. Mandibles of *Trichotichnus* dichrous Dejean

a. Left mandible, dorsal aspect; b. Right mandible, dorsal aspect; c. Left mandible, ventral aspect; d. Right mandible, ventral aspect. Fig. 4. Right maxilla, dorsal aspect, of *Trichotichnus longitarsis* Morawitz. Fig. 5. Labium, ventral aspect, of *Aztecarpalus schaefferi,* new name. Fig. 6. Labium, ventral aspect, of *Trichotichnus longitarsis,* Morawitz.

Elytra. Deplanate, sides slightly rounded, humeri broadly rounded, angulate or feebly denticulate; subapical margins feebly sinuate, without lateral teeth. Striae moderately to shallowly impressed; scutellar stria more or less reduced. Interval 3 with or without a single setigerous puncture on disc; otherwise, disc impunctate.

Legs. Average. Apical spur of front tibia more or less widened (Figs. 14 and 15; cf. Fig. 16). Hind metatarsus elongate (length of hind tibial spur/length of hind metatarsus 1.30-1.87), but shorter than combined lengths of tarsal articles 2 and 3. Anterior tarsus of male with articles broad (as in *Anisodactylus*), or average for Harpalina (Scape-Tarsal Ratio: *Aztecarpalus* 1.38-2.00; *Trichotichnus* 1.80-2.45). Anterior tibia of male average or with crenulations on anteromedial surface (Fig. 17). Hind metatarsus shorter than articles 2 plus 3 (hind tarsal ratio, males 1.05-1.24; females 1.04-1.19) but on average longer than in specimens of subgenus *Harpalus,* and about average for specimens of genus *Trichotichnus.* Inner spur of hind tibia longer than in members of *Trichotichnus* (Scape-Spur Ratio: *Aztecarpalus*—males 0.86-1.38, females 0.90-1.30; *Trichotichnus* (three males, one of *T. longitarsis* Morawitz, *T. dichrous* Dejean, and *T. vulpeculus* Say 1.50-1.83).

Hind wings. Reduced to stubs or fully developed; if latter, membrane pigmented and wedge cell small (Fig. 18; cf. Fig. 19).

Abdomen. Sternum 2 and 3 with fine sparse hairs medially; ambulatory setae present, two or four on sternum 6 (described in text as anal setae).

Male genitalia. Median lobe tubular, with dorsal membranous area extended almost to basal bulb; narrowed apically; apical portion about 0.25 times length of median lobe; apex with or without ventrally directed hook, without dorsally directed hook; ventral surface with or without denticulate projections (Figs. 20-26; cf. Fig. 27); eversion point of internal sac mediad. Internal sac complex, with from seven to 32 spines and microtrichial fields; spines large or small, medial, preapical and apical (Figs. 28-32); basal spine enlarged or not near base of internal sac, on left or right side; basal sclerite on left side (Figs. 31 and 32) or absent.

Ovipositor and associated sclerites. Tergum and sternum 8 as in Figs. 33 and 34. Tergum 10 with apical margin rounded (Fig. 36) or truncate (Fig. 36). Sternum 10 as in Fig. 43. Valvifer falciform apically, apex bluntly pointed, spines very short (Fig. 37; cf. Fig. 38). Coxite elongate with short spines near inner apical margin (Fig. 39, cf. Fig. 40). Stylus falcate, slightly varied (Fig. 30, cf. Fig. 40). Proctiger as in Fig. 41 (cf. Fig. 42).

Female genitalia. Vagina with sclerite dorsally (Fig. 43; cf. Fig. 44).

Etymology.—The generic name is a combination of Aztec, the name of the most important group of Indians living in Mexico during historic times, and the generic name *Harpalus,* in allusion to the homeland and the superficial affinities of the beetles described herein.

Geographical distribution.—The species of this genus are known from the mountain systems of Oaxaca, from the Sierra Madre Oriental, and from the lowlands in northeastern Mexico and extreme southeastern Texas. In general, they are associated with damp places, such as wet meadows (man-made), in the vicinity of forests, or stream sides.

KEY TO GROUPS OF HARPALINI OF VARIOUS SUPRASPECIFIC RANKS, OCCURRING IN MEXICO.

1. Penultimate article of labial palpus bi- or tri-setose .... Pelmatellina, Cratocarina, and Acupalpina.
   Penultimate article of labial palpus plurisetose .... 2.
2. (1) Elytron with setigerous punctures in intervals 2 and 5, or in intervals 2, 5, and 7 .... (in part) Selenophori.
   Elytron without setigerous punctures as described above .... 3.

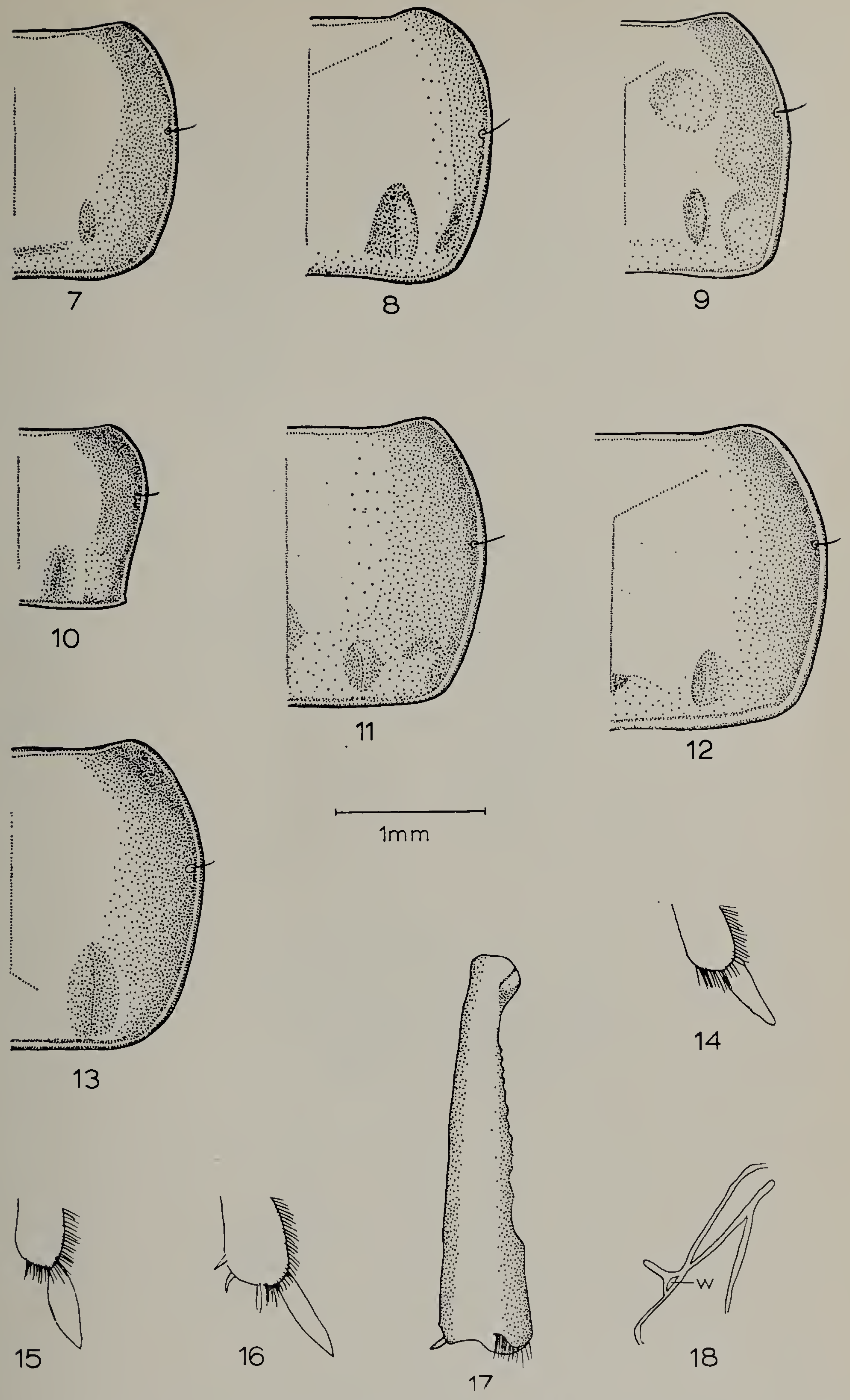
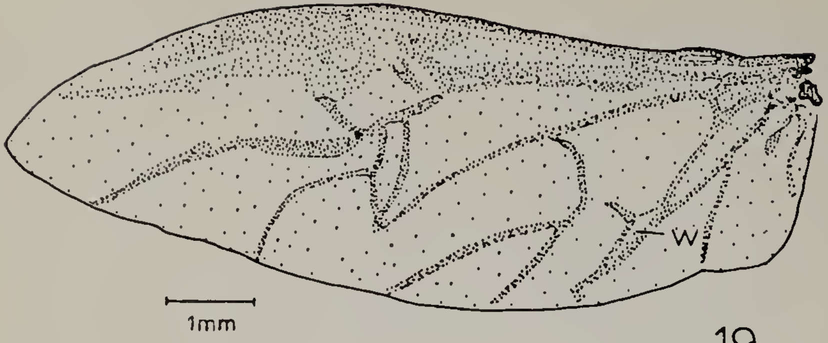


Fig. 7. Pronotum, dorsal aspect, of *Aztecarpalus hebescens* Bates. Fig. 8. Pronotum, dorsal aspect, of *Aztecarpalus platyderus* Bates. Fig. 9. Pronotum, dorsal aspect, of *Aztecarpalus lectocolus* new species. Fig. 10. Pronotum, dorsal aspect, of *Aztecarpalus liolus* Bates. Fig. 11. Pronotum, dorsal aspect, of *Aztecarpalus trochotrichis* new species. Fig. 12. Pronotum, dorsal aspect, of *Aztecarpalus schaefferi,* new name. Fig. 13. Pronotum, dorsal aspect, of *Aztecarpalus marmoreus,* new species. Fig. 14. Right front tibia, apical portion, dorsal aspect, of *Aztecarpalus lectocolus* new species. Fig. 15. Right front tibia, apical portion, dorsal aspect, of *Aztecarpalus trochotrichis* new species. Fig. 16. Right front tibia, apical portion, dorsal aspect, of *Trichotichnus dichrous* Dejean. Fig. 17. Right front tibia, dorsal aspect, of *Aztecarpalus marmoreus* new species. Fig. 18. Wedge cell and associated wing veins of *Aztecarpalus schaefferi* new name. W—wedge cell.



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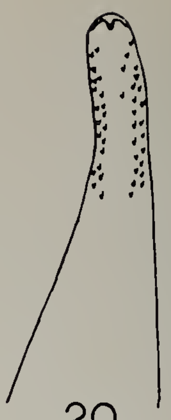

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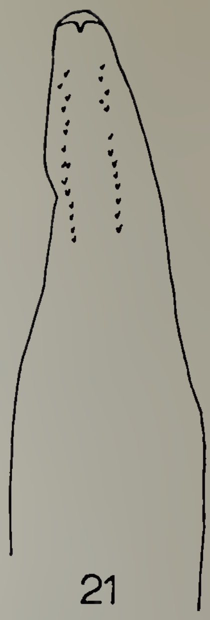

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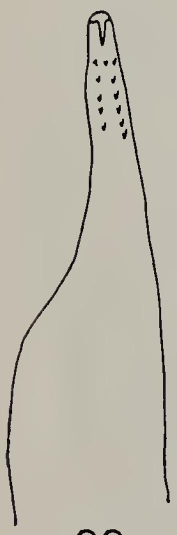

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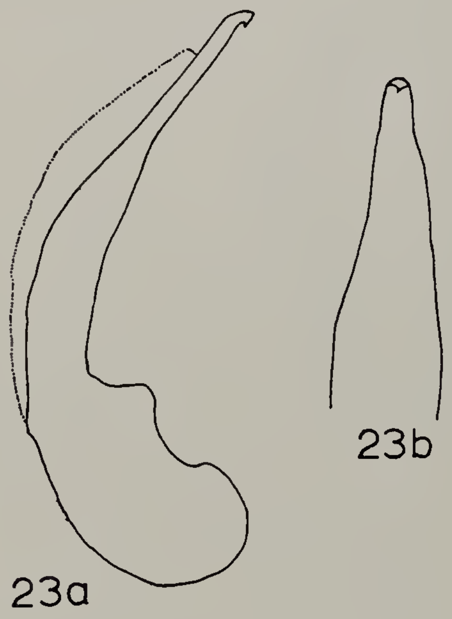

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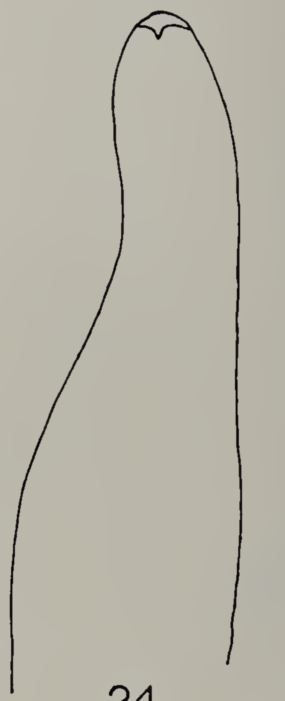

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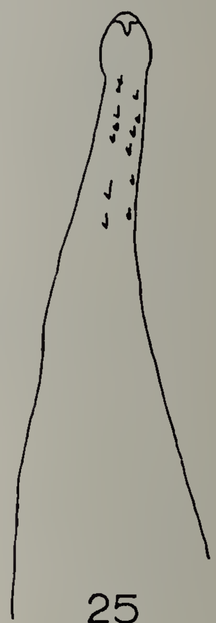

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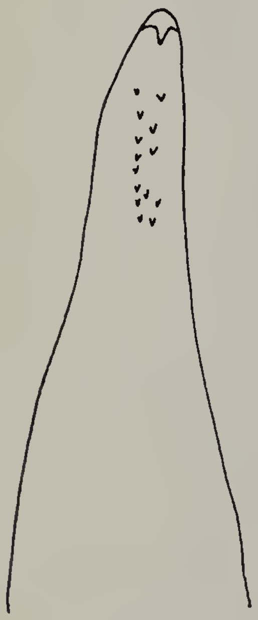

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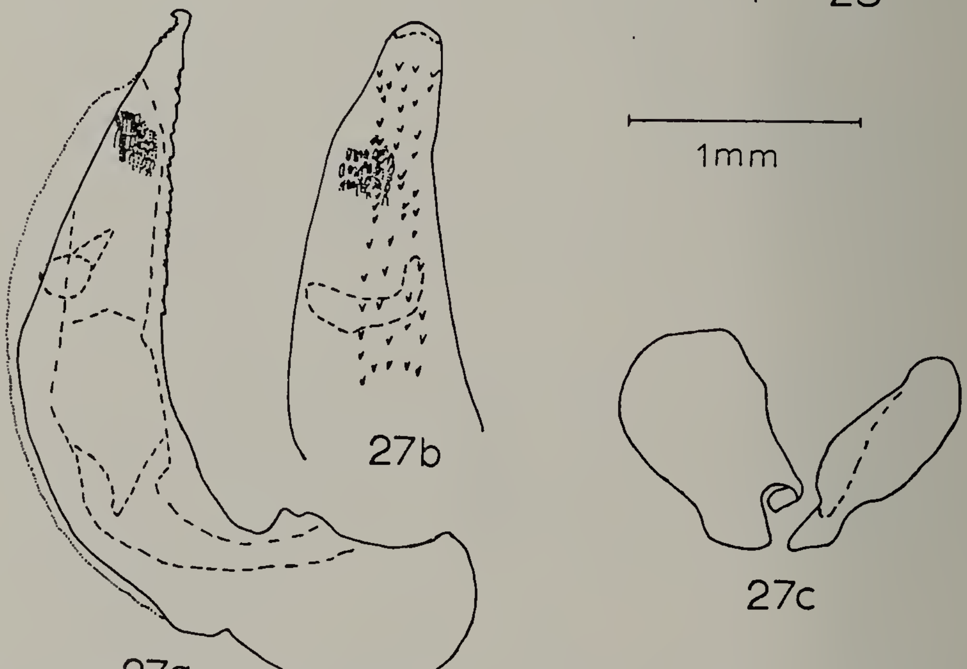

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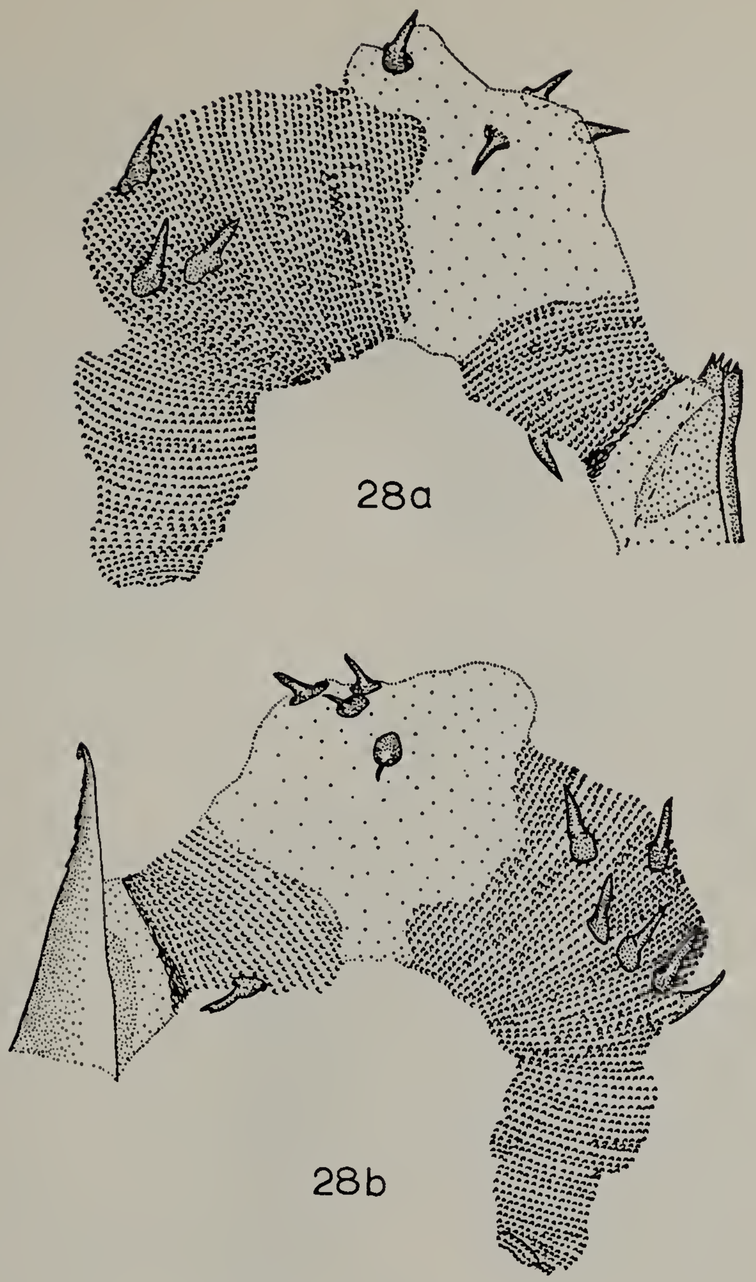
Fig. 19. Left wing of *Trichotichnus longitarsis* Morawitz. W—wedge cell. Fig. 20. Median lobe, apical portion, ventral aspect, of *Aztecarpalus hebescens* Bates. Fig. 21. Same, of *Aztecarpalus platyderus* Bates. Fig. 22. Same of *Aztecarpalus lectocolus* new species. Fig. 23. Median lobe of *Aztecarpalus liolus* Bates.

a. Left lateral aspect; b. Apical portion, ventral aspect. Fig. 24. Median lobe, apical portion, ventral aspect, of *Aztecarpalus trochotrichis* new species. Fig. 25. Same, of *Aztecarpalus schaefferi* new name. Fig. 26. Same, of *Aztecarpalus marmoreus* new species. Fig. 27. Male genitalia of *Trichotichnus longitarsis* Morawitz. a. Median lobe, left lateral aspect; b. Median lobe, apical portion, ventral aspect; c. Parameres, ventral aspect.



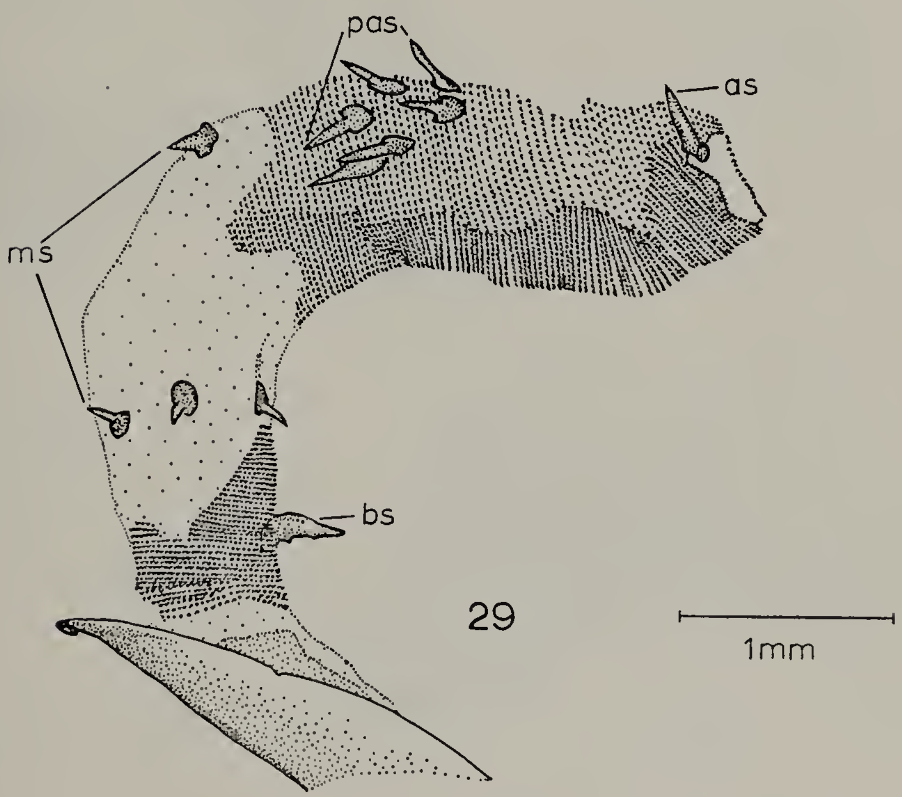
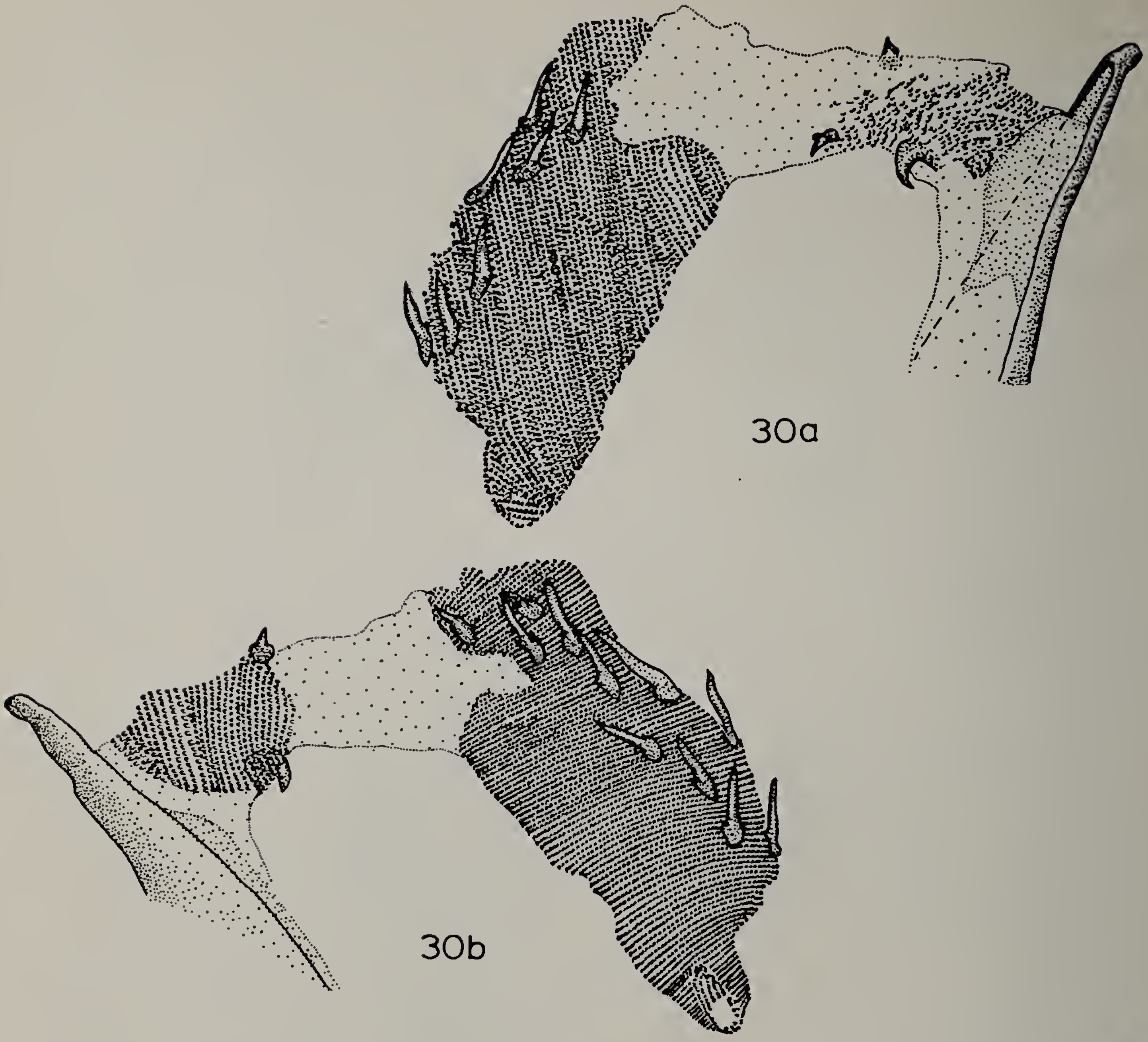


Fig. 28. Internal sac of *Aztecarpalus hebescens* Bates. a. Left lateral aspect; b. Right lateral aspect. Fig. 29. Internal sac, right lateral aspect, of *Aztecarpalus platyderus* Bates. as—apical spine; bs—basal spine; ms—medial spines; pas—pre-apical spines.



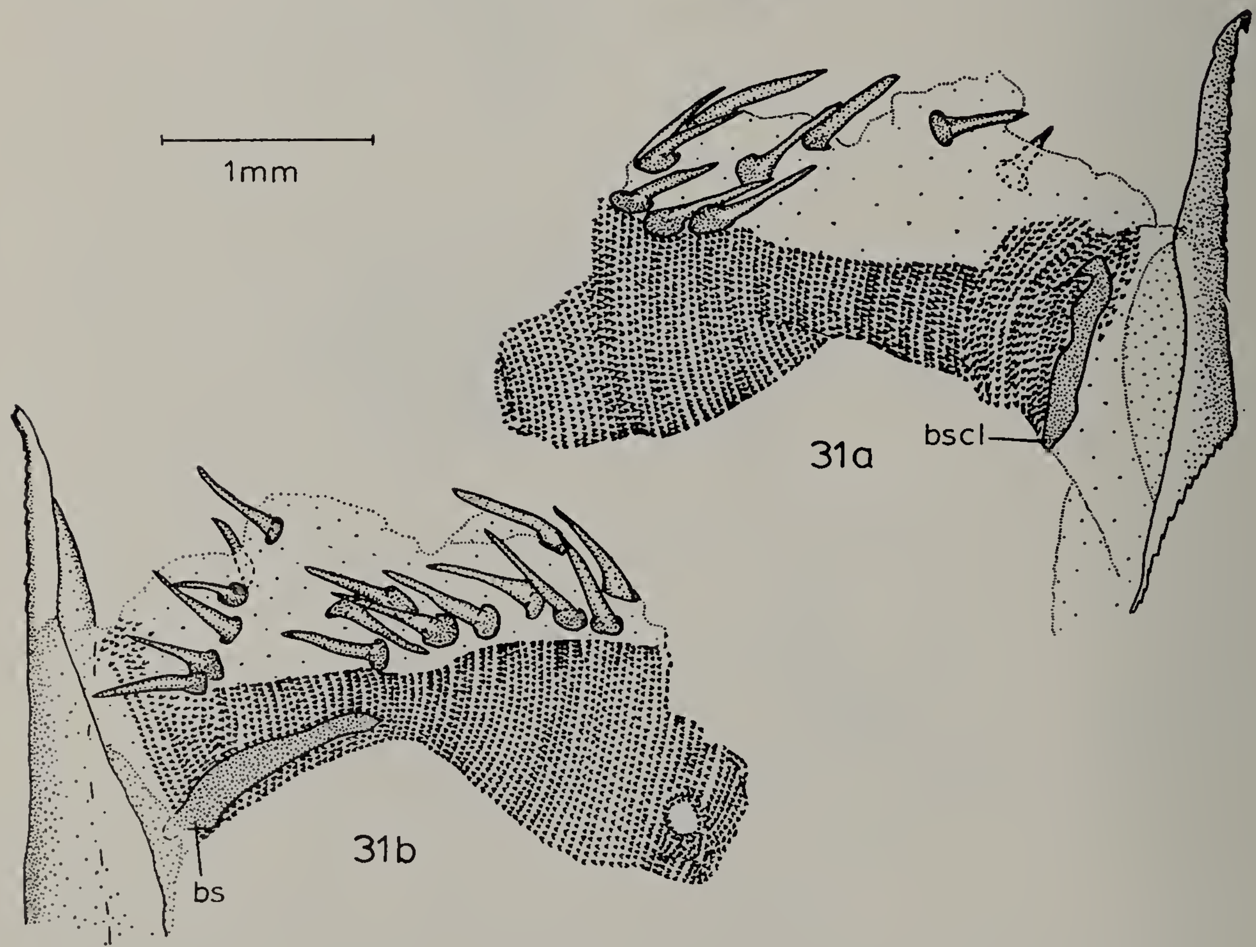
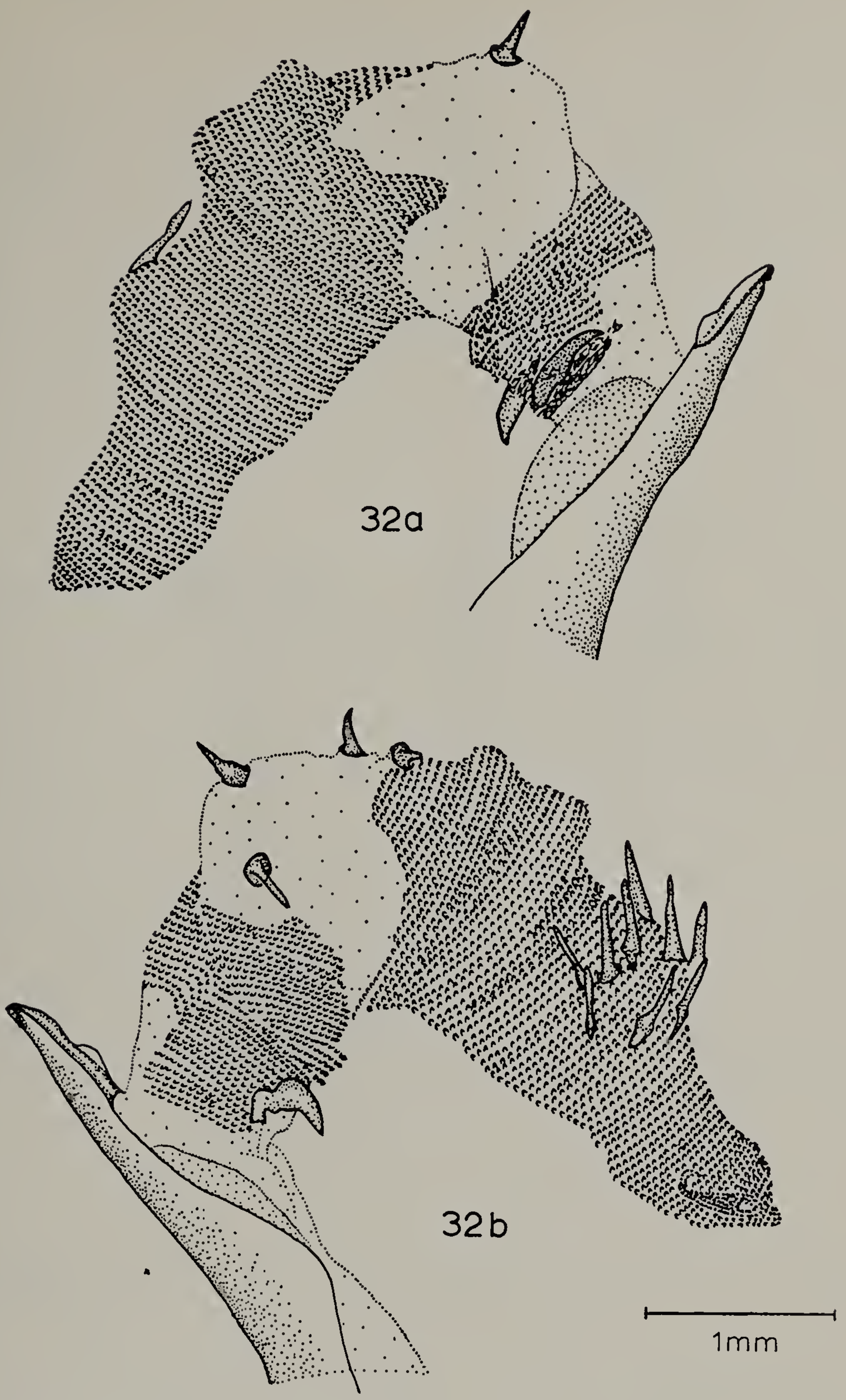
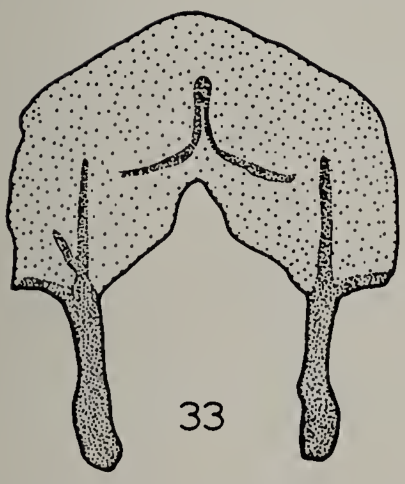


Fig. 30. Same, of *Aztecarpalus trochotrichis* new species. a. Left lateral aspect; b. Right lateral aspect. Fig. 31. Same, of *Aztecarpalus schaefferi* new name. a. Left lateral aspect; b. Right lateral aspect; bs—basal spine; bscl—basal sclerite.

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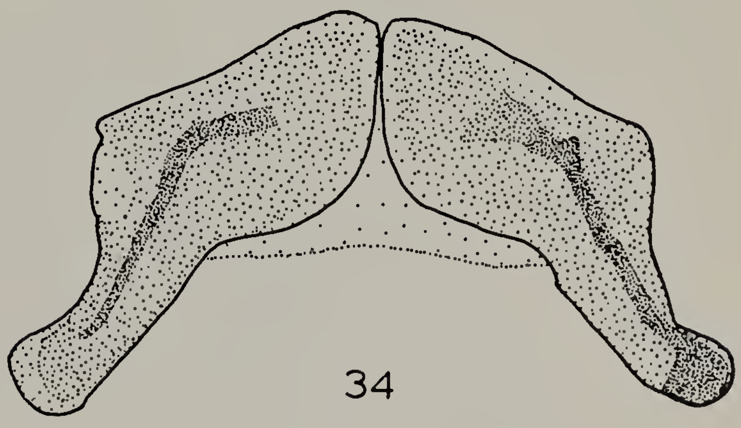
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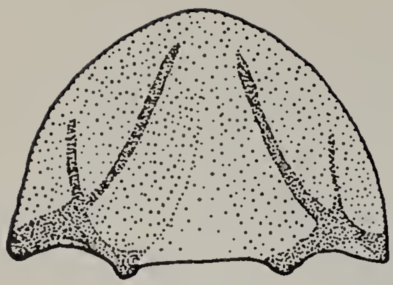
Fig. 32. Same, *Aztecarpalus marmoreus* new species. a. Left lateral aspect; b. Right lateral aspect. Fig. 33. Tergum 8, dorsal aspect, of *Aztecarpalus lectocolus* new species. Fig. 34. Sternum 8, ventral aspect, of *Aztecarpalus schaefferi* new name.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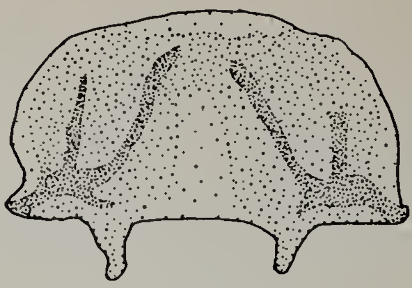
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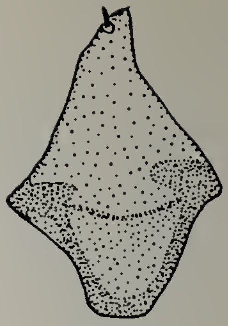
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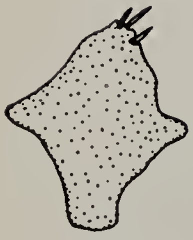
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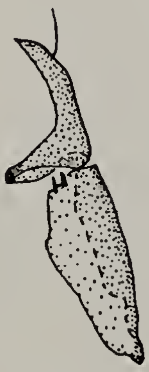
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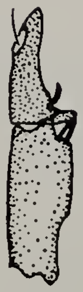
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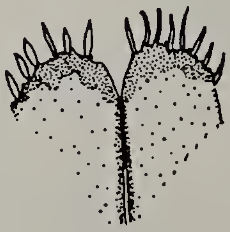
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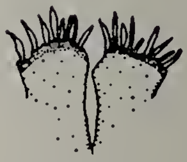
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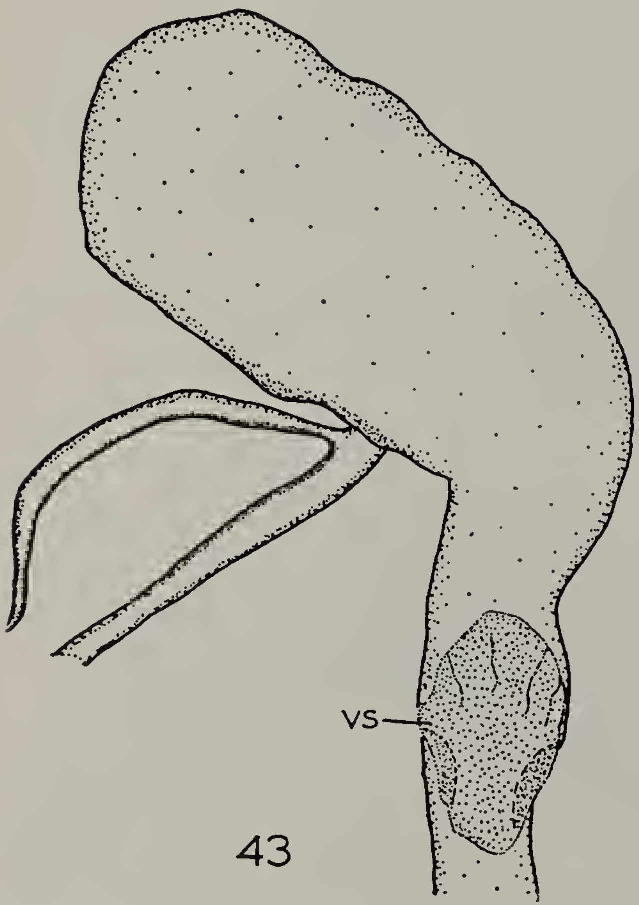

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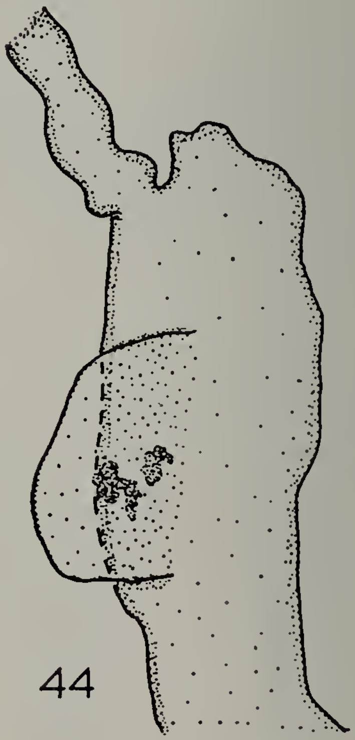
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Fig. 35. Tergum 10, dorsal aspect, of *Aztecarpalus hebescens* Bates. Fig. 36. Tergum 10, dorsal aspect, of *Aztecarpalus schaefferi* new name. Fig. 37. Valvifer, ventral aspect, of *Aztecarpalus trochotrichis* new species. Fig. 38. Valvifer, ventral aspect, of *Trichotichnus longitarsis* Morawitz. Fig. 39. Left coxite and stylus, ventral aspect, of *Aztecarpalus schaefferi*, new name. Fig. 40. Right coxite and stylus, ventral aspect, of *Trichotichnus longitarsis* Morawitz. Fig. 41. Sternum 10, ventral aspect, of *Aztecarpalus trochotrichis* new species. Fig. 42. Sternum 10, ventral aspect, of *Trichotichnus longitarsis* Morawitz. Fig. 43. Internal female genitalia, dorsal aspect, of *Aztecarpalus trochotrichis* new species. vs—vaginal sclerite. Fig. 44. Internal female genitalia, dorsal aspect, of *Trichotichnus longitarsis* Morawitz.

3. (2) Head with prominent frontal processes in front of eyes; mentum with tooth cylindrical, sharp pointed, as long as lateral lobes; pronotum with sides markedly sinuate in front of hind angles ..... **Cratacanthus.**
Head without frontal processes in front of eyes; mental tooth, if present, shorter than lateral lobes, and flat; pronotum various ..... 4.

4. (3) Anterior tibia with outer apical portion prolonged as broad spine, subequal in length to apical spine; apical spur much broader than preapical spur; elytron with large punctures in at least odd-numbered elytral intervals ..... **Euryderus.**
Anterior tibia with apical portion not prolonged as large spine ..... 5.

5. (4) Paraglossae setulose ..... **Harpalus.**
Paraglossae glabrous ..... 6.

6. (5) Elytron with umbilicate punctures in anterior and posterior series, without puncture between ..... (in part) Selenophori
Elytron with umbilicate punctures in continuous series or with a single puncture between anterior and posterior groups. ..... 7.

7. (6) Males (tarsal articles 1-4 of front and middle legs expanded, and with specialized vestiture ventrally) ..... 8.
Females (tarsal articles of front and middle legs not broader than those of hind legs) ..... 9.

8. (7) Expanded tarsal articles each with numerous rows of adhesive hairs on ventral surface—"spongy pubescence" ..... (in part) Anisodactylina.
Expanded tarsal articles with two conspicuous rows of scale-like hairs ..... **Aztecarpalus.**

9. (7) Metepisternum wider than long, hind wings absent; antennae short ..... (in part) **Aztecarpalus.**
Metepisternum longer than wide, hind wings present or absent ..... 10.

10. (9) Elytra with microsculpture lines transverse, without meshes, surface purplish or metallic blue, strongly iridescent; pronotum with hind angles rounded ..... (in part) **Aztecarpalus.**
Elytra with microsculpture meshes isodiametric or weakly transverse, surface not iridescent ..... (in part) Anisodactylina.

Key to the Species of *Aztecarpalus*, Based on External Characteristics

1. Tarsal articles with setae on dorsal surfaces ..... 2.
Dorsal surfaces of tarsal articles glabrous ..... 3.

2. (1) Pronotum with sides sinuate posteriorly, hind angles rectangular (Figs. 10 and 45), elytra with microsculpture evanescent ..... **liolus** Bates, p. 116
Pronotum with sides not sinuate posteriorly, hind angles obtuse (Fig. 9), elytra with well developed lines of microsculpture, meshes transverse ..... **lectocolus** new species, p. 115

3. (1) Elytra metallic blue or green, interval 3 of at least one elytron with setigerous puncture on disc ..... 4.
Elytra black ..... 5.

4. (3) Elytra metallic green; metepisternum wider than long; hind wings absent ..... **trochotrichis** new species, p. 118
Elytra metallic blue; metepisternum longer than wide, hind wings fully developed ..... **schaefferi** new name, p. 119

5. (3) Elytron with long scutellar stria ..... **marmoreus** new species, p. 121
Scutellar stria of elytron obsolete ..... 6.

6. (5) Pronotum as in Fig. 7; specimen from mountains of Oaxaca ..... **hebescens** Bates, p. 113
Pronotum as in Fig. 8; specimens from mountains of Puebla and Veracruz **platyderus** Bates, p. 114

Key to the Species of *Aztecarpalus* Based on Form of the Median Lobe of the Male Genitalia

1. Median lobe with ventral surface not denticulate .... 2.
Median lobe with ventral surface denticulate near apex .... 3.

2. (1) Apical portion of median lobe broad, curved to left (Fig. 24) .... **trochotrichis** new species, p. 118
Apical portion of median lobe narrow, not curved to left (Fig. 23) .... **liolus** Bates, p. 116

3. (1) Median lobe with dorsal projection on left side, near apex (Fig. 26) ... **marmoreus** new species, p. 121
Median lobe without dorsal projection on left side near apex .... 4.

4. (3) Median lobe with width of apical portion subequal to length (Fig. 21) .... **platyderus** Bates, p. 114
Median lobe with apical portion slender, several times longer than wide .... 5.

5. (4) Median lobe with apical portion straight (Fig. 22) .... **lectocolus** new species, p 115
Median lobe with apical portion curved to left or right (Figs. 20 and 25) .... 6.

6. (5) Median lobe with apical portion curved to right (Fig. 25) .... **schaefferi** new name, p. 119
Median lobe with apical portion curved to left (Fig. 20) .... **hebescens** Bates, p. 113

Key to the Species of *Aztecarpalus* Based on Characteristics of the Internal Sac of the Male Genitalia

1. Internal sac with basal spine on left side .... 2.
Internal sac with basal spine on right side .... 3.

2. (1) Internal sac with apical spine (Fig. 29) .... **platyderus** Bates, p. 114
Internal sac without apical spines (Fig. 30) .... **trochotrichis** new species, p. 118

3. (1) Internal sac with basal sclerite (Figs. 31 and 32) .... 4.
Internal sac without basal sclerite (Fig. 28) .... 5.

4. (3) Basal spine very large; preapical area with numerous long spines (Fig. 31) .... **schaefferi** new name, p. 119
Basal spine shorter; preapical area with few spines (about 5) (Fig. 32) .... **marmoreus** new species, p. 121

5. (3) Spines numerous (more than 15), all short .... **lectocolus** new species, p. 115
Spines less than 15, some long, some short .... 6.

6. (5) Spines of medial group longer than those of preapical group .... **liolus** Bates, p. 116
Spines of preapical group longer than those of medial group (Fig. 28) .... **hebescens** Bates, p. 113

Species Groups and Descriptions

The seven species of this genus are arranged in four groups: the *hebescens* group; the *liolus* group; the *trochotrichis* group; and the *schaefferi* group. The groups and species are characterized below.

The *hebescens* Group

The diagnostic characteristics of this group are: pronotum with hind angles rounded; elytra black, iridescent or not, meshes formed by microsculpture wide, transverse or isodiametric; tarsal articles with dorsal surfaces glabrous; articles of male front tarsus average for genus, inner hind tibial spur of average length; anal setae of males two or four; median lobe of male genitalia with denticles ventroapically; internal sac with basal spine on right or left side; spines of medial group shorter than those of preapical group, both groups with eight or fewer spines, tergum 10 of female with apical margin rounded.

This group includes two species: *hebescens* Bates and *platyderus* Bates. The species are known from the mountains of Puebla, Veracruz and Oaxaca, only.

Aztecarpalus hebescens Bates
Figs. 7, 20, 28, 35

Harpalus hebescens Bates, 1882; 57. LECTOTYPE (here selected) a male, BMNH, labelled as follows: "SYNTYPE [circular label, white paper trimmed with blue]; TYPE H. T. [circular label, white paper trimmed with red]; Capulalpam; Mexico Salle Coll; BCA Col. I. 1., Harpalus hebescens Bates; Harpalus hebescens Bates" [handwritten]

NOTES.—A second specimen of this species, also a male and collected at Capulalpam, in the British Museum Collection, is labelled *Harpalus alienus* Bates. A specimen of this species in the Oberthür collection (MHNP) is labelled *Harpalus aequicollis* Chaudoir. This name was not published.

DESCRIPTION.—Total length, males 7.9-8.6 mm, females 8.4-9.8 mm.

Color. Black, except following. Piceous, median portion of venter of thorax and abdomen. Rufous, maxillae, labial appendages and tarsi. Infuscated, antennal articles 4-11, coxae and trochanters. Antennal articles 1-3 rufous or infuscated.

Setae. Middle coxae each with five—10 setae; middle femora of male each with four setae ventro-anteriorly near base, of female, each with three ventro-anterior setae. Elytra each with interval 3 impunctate. Anal setae four in males and females.

Microsculpture. Meshes isodiametric to slightly transverse. Clypeus, meshes fine, transverse. Head, meshes fine, transverse laterally, isodiametric on frons and vertex. Pronotum with fine lines, meshes narrow, transverse, but isodiametric or longitudinally stretched in posterior-lateral impressions. Elytra with meshes relatively wide, slightly transverse to isodiametric, more transverse in males than in females.

Luster. Dorsal surface shining to faintly iridescent.

Head. Frontal impressions broad, circular basins (in lectotype with small prolongations toward compound eyes).

Pronotum. As in Fig. 7. Sides rather strongly rounded, hind angles broadly obtuse. Posterior-lateral impressions shallow, linear.

Legs. Anterior tibia with terminal spur broad, as in Fig. 15. Male front tibia gradually narrowed apically with crenulate antero-medial surface not swollen. Male front tarsi with articles broad (Scape-Tarsal ratio for five specimens, 1.40-1.60). Scape-Tibial Spur Ratio: five males 0.94-1.14; four females 0.94-1.00.

Metepisternum. About 1.5 times wider than long.

Elytra. Humeri angulate, not denticulate. Striae moderately impressed, scutellar stria obsolete.

Hind wings. Absent.

Male genitalia. Median lobe in ventral aspect sinuate, with apical portion curved to left; apical portion slender, long, with denticles in two irregular rows (Fig. 20); apex rounded, with short hook. Internal sac as in Figs. 28a and b. Basal spine on right side, of average size; medial area with two-six short spines; preapical area with three-eight long spines (five specimens examined).

Female abdomen. Tergum 10 with apical margin rounded, as in Fig. 35.

Collecting notes.—Specimens of this species were collected in May and October at altitudes of 7900' and 8300'. They were found under stones and logs in a meadow at the edge of a pine forest, and in an overgrazed pasture at the edge of a pine-oak forest. The areas were damp.

Distribution.—This species is known only from the state of Oaxaca, Mexico. I have seen six males and four females from the following localities. OAXACA. Capulalpam (BMNH). 53.8 mi. s. Valle Nacional, 8300', V.3.66 (UASM). 54.1 mi. s. Valle Nacional, 8300', VIII.18.65 (UASM). 97.3 mi. s. Valle Nacional, 7900', VIII.19.65.

Aztecarpalus platyderus Bates

Figs. 8, 21, 29

Harpalus platyderus Bates, 1882: 57. LECTOTYPE (here selected), male, labelled as follows: Syntype [circular label, white, ringed with lavender color]; Orizaba; Mexico Sallé Coll; [rectangle of green paper]; BCA coll I. 1, Harpalus platyderus Bates; Harpalus platyderus apud Sallé. (BMNH).—Csiki, 1932: 1184.

NOTES.—Additional specimens in the type series are two females, one collected at Las Vigas, Veracruz, and the other at San Antonio de Arriba. The Las Vigas specimen looks like the male and is probably conspecific with it. The San Antonio de Arriba specimen, on the other hand, seems sufficiently different in form to be included in a separate species. However, no males that I have seen match this specimen, and I do not know the position of the locality in which the specimen was collected. It seems best, therefore, to record the specimen as *incertae sedis*.

DESCRIPTION.—Total length two males, 9.20-10.28 mm; five females, 9.50-10.58 mm.

Color. Black to piceous, except rufous tarsi, maxillae, and labial appendages. Antennae with articles 2-11 rufous to infuscated.

Setae. Middles coxae each with 10 setae. Middle femora of males each with four—six setae antero-ventrally, near base; females with three setae. Elytra each with interval 3 impunctate. Anal setae two in male, four in females.

Microsculpture. Dorsum of head with isodiametric meshes. Pronotum with meshes slightly transverse, more or less isodiametric posteriorly. Elytra, meshes slightly transverse to isodiametric.

Luster. Dorsum of males shining, of females subopaque.

Head. Frontal impressions large, basin-like, grooves in bottom curved toward eyes.

Pronotum. As in Fig. 8; disc flatter than in *hebescens*, otherwise similar.

Legs. Anterior tibia with terminal spur broadened (as in Fig. 15). Male front tibia with crenulate antero-medial face, not swollen. Articles of male front tarsi broad (Scape-Tarsal Ratio, one male 1.38). Scape-Tibial Spur Ratio: male 1.06; three females 0.90-1.13.

Metepisternum. Slightly wider than long.

Elytra. Humeri angulate, not denticulate. Striae moderately impressed, scutellar stria obsolete.

Hind wings. Absent.

Male genitalia. Median lobe in ventral aspect sinuate, apical portion straight, rather short and broad, ventrally with two rows of denticles and short apical hook (Fig. 21). Internal sac as in Fig. 29; basal spine prominent; medial area with two—eight short spines; preapical area with six—seven long spines; apical area with one—two long spines (Fig. 29).

Female abdomen. Tergum 10 with apical margin rounded, as in Fig. 35.

Distribution.—This species is known only from the eastern-most slopes of the Trans-Volcanic Sierras. I have seen six specimens, from the following localities.

VERACRUZ. Orizaba (BMNH). Las Vigas (BMNH). Citlaltepetl, east slope, 9500', L. W. Swan (CAS).

The *liolus* Group

The diagnostic characteristics of this group are: pronotum with hind angles subangulate, elytra piceous or purplish, meshes of microsculpture transverse and narrow, or absent; tarsal articles with dorsal surfaces sparsely setose; articles of male front tarsus narrower than average; inner hind tibial spur shorter than average, especially in males, anal setae two in males; median lobe of male genitalia ventro-apically denticulate or not; internal sac with basal spine on right side, right basal sclerite absent, spines of medial and preapical areas short; tergum 10 of female with apical margin rounded.

This group includes two species the members of which are known from the mountains of Oaxaca, only. These are *liolus* Bates and *lectocolus* new species.

Aztecarpalus lectocolus new species

Figs. 9, 14, 22, 30, 33.

The diagnostic characteristics of this species are indicated in the keys.

DESCRIPTION.—Total length, males 8.3-8.4 mm; females 7.6-8.4 mm.

Color. Body black. Legs, tarsi excluded, rufo-piceous. Antennal scape and articles 2-3 black, articles 4-11 rufous laterally, infuscated medially; tarsi, maxillae and labial appendages rufous. Elytra purplish.

Setae. Middle tibiae each with two rows of five to six setae ventro-anteriorly. Middle coxae each with few setae (between five and 10). Elytra each with interval 3 impunctate. Anal setae two in males, four in females.

Microsculpture. Clypeus and dorsum of head with meshes isodiametric to slightly transverse, lines coarser in females than in males. Pronotum with lines fine, meshes transverse, narrow. Elytra with meshes strongly transverse.

Luster. Pronotum and elytra brightly shining, iridescent.

Head. Frontal impressions circular, shallow, broad.

Pronotum. As in Fig. 9. Hind angles narrowly obtuse, areas subtended by hind angles broadly flattened. Posterior-lateral impressions shallow, elongate grooves.

Legs. Anterior tibia with terminal spur rather slender (Fig. 14). Male front tibia with antero-medial surface crenulate, not swollen (Fig. 17). Scape-Tarsal Ratio, two males 1.80-2.00. Scape-Tibial Spur Ratio: males 1.28-1.38, two females 1.08-1.21.

Metepisternum. About 1.25 times wider than long.

Elytra. Humeri angulate, feebly denticulate. Striae moderately deeply impressed, scutellar stria short. Intervals feebly convex.

Hind wings. Absent.

Male genitalia. Median lobe in ventral aspect sinuate, apical portion more or less straight; apex subtruncate, with long hook; apical portion slender, long, with two rows of denticles (Fig. 22). Internal sac as in Figs. 30a and b; basal spine small, on right side; medial area with eight short spines; preapical area with nine short spines (one specimen examined).

Female abdomen. Tergum 10 with apical margin rounded, as in Fig. 35.

Derivation of name.—From Latin, *lectus,* bed or litter; and *colus,* dweller in; alluding to the occurrence of the members of this species in leaf litter.

Material examined.—I have seen four specimens of this species. The holotype (male) and allotype are labelled as follows: Mex. Oaxaca, 22.2 mi. s. Juchatengo, 5800′; VII.21-22.66; G. E. Ball and D. R. Whitehead, collectors. Of the two paratypes, females, one is labelled as above, and the other as follows: Mex. Oaxaca; 88.5 mi. s. Valle Nacional, 8000', V.2.66; G. E. Ball and D. R. Whitehead, collectors. The holotype and allotype are in the entomological collection of the MCZ. The paratypes are in UASM.

Collecting notes.—These specimens were collected on steep mountain slopes in Mexican cloud forest, in damp leaf litter. Specimens of *A. trochotrichis* new species were also collected 88.5 miles south of Valle Nacional.

Distribution.—This species is known only from the mountains of Oaxaca.

Aztecarpalus liolus Bates

Figs. 10, 23, 45

Harpalus liolus Bates, 1882: 58. Type material two males, Box No. 225. Oberthür Collection, MHNP.—Tschitscherin, 1900: 363.

Trichotichnus liolus; Csiki, 1932: 1220.

NOTES.—Tschitscherin (1900) suggested that *Harpalus liolus* Bates belonged in the genus *Asmerinx* Tschitscherin, or in a related group. However, he did not make the transfer, formally. Subsequently, *Asmerinx* was combined with *Trichotichnus* and *H. liolus* Bates was placed in the latter genus (Csiki, 1932).

DESCRIPTION.—Total length, male, 6.3 mm., females, 6.7-6.9 mm. Form as in Fig. 45.

Color. Body rufo-piceous. Rufo-testaceous—antennae, maxillae, labial appendages.

Setae. Dorsal surfaces of tarsal articles each with few long setae. Male and female with seven setae antero-ventrally on each middle femur. Middle coxae each with few setae (five). Interval 3 of elytron without setigerous puncture. Anal setae two in males, four in females.

Microsculpture. Head, pronotum, and elytra with lines almost effaced. Meshes, if formed, narrow and transverse.

Luster. Surface shining, head and pronotum feebly iridescent.

Head. Frontal impressions basins, each with shallow groove directed toward compound eye.

Pronotum. As in Fig. 10; sides sinuate posteriorly, hind angles rectangular; areas subtended by hind angles flattened. Posterior-lateral impressions linear, rather shallow. Basal and lateral margins beaded.

Legs. Anterior tibia with terminal spur broadened (as in Fig. 15). Male front tibia with antero-medial surface not crenulate near base, not swollen. Scape-Tarsal Ratio 1.86. Scape-Tibial Spur Ratio: Male and female 1.30.

Metepisternum. About 1.25 times wider than long.

Elytra. Striae moderately impressed, scutellar stria obsolete. Intervals flat except 7 and 8, these subcarinate before apex.

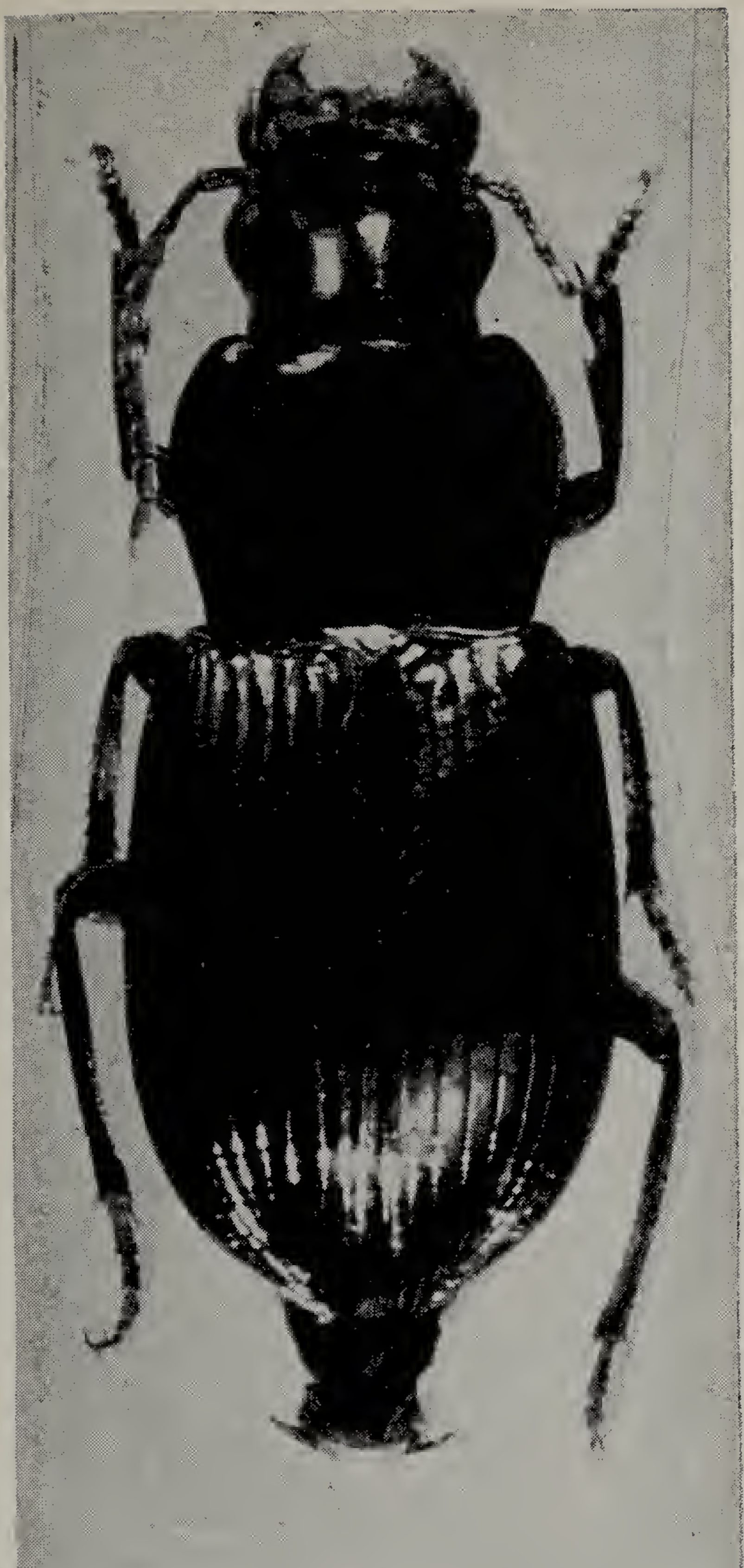
Hind wings absent.

Male genitalia. Median lobe in ventral aspect sinuate on left side, apical portion straight; apical portion narrow, moderately long, without denticles, and with short apical hook (Fig. 23). Internal sac: basal spine not strongly curved, hardly enlarged; medical area with four spines; preapical area with six spines.

Female abdomen. Tergum 10 with apical margin rounded, as in Fig. 35.

Collecting notes.—D. R. Whitehead and I collected specimens in the vicinity of a dried up pond in Mexican cloud forest. The area was wet and densely shaded by oak trees. The leaf litter was shallow. The beetles were under stones, and about four hours were spent to obtain the three specimens.

Distribution.—This species is known from the Atlantic slopes of the



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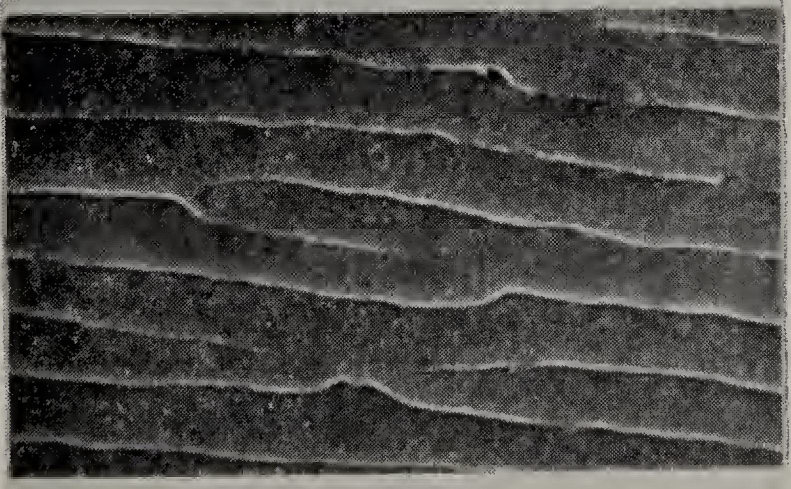

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Fig. 45. Photograph, dorsal aspect, of *Aztecarpalus liolus* Bates. Taken by J. S. Scott. Fig. 46. Photograph, microsculpture of elytron of *Aztecarpalus schaefferi,* new name, taken at 3000 X.

Oaxacan mountains. I have seen five specimens: the type material, labelled "Mexico" (MHNP), and three specimens collected in Oaxaca, 16.9 mi. s. Valle Nacional, 3600', V.4-5.66 (UASM).

The *trochotrichis* group

The diagnostic characteristics of this group are: pronotum with hind angles rounded; elytra green with dorsal surface not iridescent, microsculpture meshes transverse or absent from disc, interval 3 with single discal puncture; tarsal articles with dorsal surfaces glabrous; articles of male front tarsus of average width for genus; inner hind tibial spur of average length for genus; anal setae of male four; median lobe of male genitalia without denticles on apical portion of ventral surface, apical portion straight, apex broadly rounded; internal sac with basal spine on left side, basal sclerite absent; spines of medial group few, short, spines of preapical group numerous, long; tergum 10 of female with apical margin rounded.

This group includes a single species, *Aztecarpalus trochotrichis* new species.

Aztecarpalus trochotrichis new species

Figs. 11, 15, 24, 30, 37, 41, 43

Anisotarsus cyanippus var. Bates, 1882: 51.

Anisotarsus hilariolus; van Emden (in part), 1953: 534.

Notes.—The above synonymy refers to a single specimen labelled "Harpalus agonoderus Chaud. apud Salle", a name that was not published by Chaudoir.

Description.—Total length male 9.4 mm., females 9.1-9.6 mm.

Color. Black, except the following. Rufous, maxillae, labial appendages and tarsi. Metallic green, elytra.

Setae. Average, except male with sparse brush of setae on lower surface of middle femur, and each hind trochanter with about 20 fine setae; female with few extra setae at base of middle femur and two setae on each hind trochanter. Interval 3 of elytron with single seta in apical 1/3. Anal setae four in males, four in females.

Microsculpture. Dorsal surface of head with transverse meshes (female) or lines effaced (male). Pronotum, meshes transverse on disc, almost isodiametric in posterior-lateral impressions. Elytra, in male, lines fine on apices only, in females meshes transverse throughout elytra.

Luster. Dorsal surface shining, head and pronotum in female faintly iridescent.

Head. Frontal impressions broad, rather elongate basins.

Pronotum. As in Fig. 11; moderately flattened, hind angles obtuse; posterior lateral impressions irregular basins separated from lateral depressions.

Legs. Anterior tibia with terminal spur broadened (Fig. 15). Male front tibia with antero-medial surface slightly swollen, crenulations well developed (as in Fig. 17). Scape-Tarsal Ratio 1.63. Scape-Tibial Spur Ratio: male 1.12; two females 1.06-1.13.

Metepisternum. About 1.5 times wider than long.

Elytra. Humeri angulate, not toothed; striae moderately deeply impressed, scutellar stria reduced; intervals feebly convex.

Hind wings. Absent.

Male genitalia. Median lobe sinuate in ventral aspect, apical portion curved to left; apical portion broad, apex broadly rounded, with short apical hook; ventral surface without denticles (Fig. 24). Internal sac as in Fig. 30a and b; basal spine on left side of sac, broad, curved; medial area with two short spines; preapical area with 19 long spines.

Female abdomen. Tergum 10 with apical margin rounded, as in Fig. 35. Sternum 10 as in Fig. 41. Vagina and bursa copulatrix as in Fig. 43.

Derivation of name.—From Greek, *trochis* meaning runner; (a synonym of trochanter) and *trichis* meaning hair; in allusion to the hairs on the male trochanters.

Material examined.—I have seen four specimens of this species. The holotype, allotype, and paratype are labelled as follows: "Mex. Oaxaca. 88.5 mi. s. Valle Nacional, 8000', V.2.1966. G. E. Ball and D. R. Whitehead Collectors". The holotype and allotype are in the MCZ. The paratype is in the UASM. The fourth specimen is a female, collected at Capulalpam, Oaxaca (BMNH) and included by Bates and van Emden in *Anisotarsus* (see "Notes", above).

Collecting notes.—Specimens of this species were collected in damp leaf litter, in Mexican cloud forest, along with specimens of *A. lectocolus.*

Geographical distribution.—This species is known only from the mountain forests of Oaxaca, on the Atlantic slope.

The *schaefferi* Group

The diagnostic characteristics of this group are: pronotum with hind angles rounded; elytra black or purplish, iridescent, microsculpture meshes of dorsal surface narrow and transverse; male front tarsi average width for genus; inner hind tibial spur various; anal setae of male two or four; median lobe of male genitalia with denticulations ventro-apically; internal sac with basal spine on right side, left side at base with large sclerite; medial and preapical areas with few to many spines; tergum 10 of female with apical margin subtruncate.

This group includes the two species *A. schaefferi* new name and *A. marmoreus,* new species. The members of this species group are known from the eastern portion of the Trans-Volcanic Sierra, the Sierra Madre Oriental, and extreme southeastern Texas.

Aztecarpalus schaefferi new name

Figs. 2, 5, 12, 18, 25, 31, 34, 36, 39, 46

Harpalus iripennis Schaeffer, 1910: 432 (not Say, 1824). LECTOTYPE male, collected on the Esperanza Ranch, Brownsville, Texas (USNM).—Leng, 1920: 71.

Pteropalus iripennis; Casey, 1913: 133

Trichotichnus iripennis; Csiki, 1932: 1220.—Lindroth, 1968: 820.

NOTES.—I have not seen the lectotype, but I have studied three specimens of this species labelled as Cotype No. 42510, and collected at the type locality.

The names *Harpalus iripennis* Say and *Harpalus iripennis* Schaeffer are primary homonyms, even though the species named by Say was removed from *Harpalus* and placed in the genus *Selenophorus* before Schaeffer used the specific name *H. iripennis*. According to the Code, a junior primary homonym is invalid as the name of a species, so I re-named Schaeffer's species, using his surname as the specific epithet.

DESCRIPTION.—Total length (10 males, 10 females, Chipinque Mesa, Monterrey, Nuevo Leon), males 9.6-11.2 mm., mean 10.6 mm; females, 10.1-11.2 mm., mean 10.6 mm.

Color. Black except dark purplish or blue elytra, and rufous apical portions of terminal palpal articles.

Setae. Average, male without special brushes on legs. Elytra each with a setigerous puncture in interval 3, or puncture absent from one elytron. Anal setae four in males, four in females.

Microsculpture. Clypeus and head, lines fine, meshes slightly transverse to isodiametric, lines coarser in males than in females. Pronotum with narrow transverse meshes. Elytra with very fine lines, meshes not formed (Fig. 46).

Luster. Dorsal surface shining, elytra strongly iridescent, head and pronotum less strongly so.

Head. Frontal impressions broad, shallow basins. Mouthparts as in Figs. 2 and 5.

Pronotum. As in Fig. 12; moderately flattened, hind angles obtuse; posterior lateral impressions rather linear, shallow, widely isolated from side grooves.

Legs. Anterior tibia with terminal spur broadened (as in Fig. 15). Male front tibia with crenulations on antero-medial surface as in Fig. 17, not swollen toward base. Scape-Tarsal Ratio, 10 males 0.81-1.12; 10 females 0.95-1.06.

Metepisternum distinctly longer than wide.

Elytra. Humeri angulate, not denticulate. Striae moderately deeply impressed, scutellar stria long. Intervals feebly convex.

Hind wings. Fully developed, as in Fig. 19; membrane with dark pigment; wedge cell as in Fig. 18.

Male genitalia. Median lobe in ventral aspect sinuate, apical portion curved to right; apex narrowly rounded; apical portion slender, long, with short apical hook and two rows of ventral denticles (Fig. 25). Internal sac as in Figs. 31a and b; basal spine on right side, very large; basal sclerite on left side; medial area with seven—18 long spines; preapical area with nine—17 long spines (eight specimens dissected).

Female abdomen. Sternum 8 as in Fig. 34. Tergum 10 with apical margin subtruncate (Fig. 36). Coxite and stylus as in Fig. 39.

COLLECTING NOTES.—Specimens of this species were collected in localities ranging from sea level to 4900'. Excluding the type specimens all of the material I have seen was collected in October. Specimens were found in the vicinity of rather open forests (oak forest in Chipinque Mesa, thorn forest in Tamaulipas), near streams or damp places. They were under stones or in thin litter.

GEOGRAPHICAL DISTRIBUTION.—This species is known from northeastern Mexico and extreme southeastern Texas. I have seen 23 males and 35 females of this species, collected in the following localities.

MEXICO

NUEVO LEON. Rte. 60, 1.1 mi. e. Iturbide, 4800'. Rte. 60, 1.3 mi. e. Iturbide, 4800'. Rte. 60, 12.0 mi. w. Linares, 2100'. Rte. 60, 14.8 mi. w. Linares, 2400'. Rte. 85, 11.7 mi. n. Montemorelos, 1550'. Rte. 85, Rio Blanquillo, 7.0 mi. n. Montemorelos, 1640'. 32.9 mi. n. Montemorelos, 1700'. Chipinque Mesa, Monterrey, 4000'.

TAMAULIPAS. 27.5 mi. w. Soto la Marina, 1600'. 20.6 mi. e. Villa de Casas, 1500'. 23.1 mi. e. Villa de Casas.

UNITED STATES

TEXAS. Cameron County: Esperanza Ranch, Brownsville, VI. 14.

Aztecarpalus marmoreus new species

Figs. 13, 17, 26, 32

Description.—Total length, male 10.7 mm., females, 10.0-10.3 mm.

Color. Black, or dark piceous, except the following. Rufous—lateral areas of antennal articles 4-11, maxillae, labial appendages and tarsi.

Setae. Tarsi glabrous dorsally; middle coxae each with about 10 setae; middle femora of male each with sparse brush of about 30 setae ventrally, female with three setae ventro-anteriorly. Interval 3 of elytron without setigerous punctures. Anal setae two in male, four in females.

Microsculpture. Clypeus with lines fine, meshes slightly transverse. Head anteriorly and laterally with meshes slightly transverse, vertex with meshes isodiametric, lines fine. Pronotum with meshes narrow, transverse, meshes longitudinally oriented posteriorly in posterior-lateral impressions. Elytra with lines fine, meshes slightly transverse.

Luster. Dorsal surface shining, pronotum feebly iridescent on disc.

Head. Frontal impressions broad, basins shallow.

Pronotum. As in Fig. 13; sides rather strongly constricted posteriorly. Posterior-lateral impressions linear, shallow, well isolated from lateral grooves by convex area.

Legs. Anterior tibia with terminal spur broadened as in Fig. 15. Male front tibia with crenulations, antero-medial surface not swollen (Fig. 17). Scape-Tarsal Ratio 1.66. Scape-Tibial Spur Ratio: male 1.25; two females 0.94-1.12.

Metepisternum about 1.5 times wider than long.

Elytra. Striae shallow, scutellar stria well developed, intervals flat.

Hind wings. Absent.

Male genitalia. Median lobe with prominent projection on left side of apical portion; in ventral aspect sinuate, apical portion straight, long, narrow, with two rows of denticles; apex narrow, with short hook (Fig. 26). Internal sac as in Figs. 32a and b; basal spine on right side curved; basal sclerite on left side; medial area with five short spines; preapical area with 13 long spines.

Female abdomen. Tergum 10 with apical margin subtruncate, as in Fig. 36.

Derivation of name.—From Latin, *marmoreus,* meaning marble. This name alludes to the type locality, Barranca de los Marmoles, which freely translated is "valley of the marbles".

Material examined.—This species is known from one male and three females, labelled as follows: "Mex. Hidalgo. Barranca de los Marmoles, 0.4 mi. s. San Vicente, Rte. 85, 7100'; X.2.65. G. E. Ball and D R. Whitehead, collectors". The holotype (male) and allotype are in the MCZ. Two paratypes are in UASM.

COLLECTING NOTES.—These specimens were collected in an open field, near a wet, oak-pine forest.

EVOLUTIONARY CONSIDERATIONS

Although the limited material available requires one to exercise considerable caution in approaching the topic of evolution of *Aztecarpalus,* still some data are sufficiently suggestive to warrant comment.

The general similarities between the members of *Trichotichnus* and *Aztecarpalus* suggest a remote common ancestry. The members of *Aztecarpalus* have some characteristics which might be very primitive among the "trichotichnoids": weakly developed fronto-ocular grooves, and isodiametric microsculpture (females of *hebescens* and *platyderus).* The geographical distribution of this pair of genera (American *Trichotichnus* confined to eastern North America; *Aztecarpalus* confined to eastern Mexico) suggests that time of divergence was pre-Miocene. Their pattern suggests that they are members of the Arcto-Tertiary biota, some of whose members reached Mexico in early Tertiary time, where they became isolated when the grasslands formed in northern Texas (Martin and Harrell, 1957). Savage (1966: 744-745) assigns taxa with similar distribution patterns to the "Old Northern Element" of the Central American biota.

In conclusion, morphological and chronological evidence point to a long-standing residence of *Aztecarpalus* in Mexico—seemingly long enough for the group to have undergone a much more extensive evolution than is shown by present knowledge of its diversity. I think that more species of *Aztecarpalus* are to be found, and that the additional material will make possible a reasonable reconstruction of the evolutionary history of the genus.

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3.0020. The Species of the Mexican Genus *Aztecarpalus*, New Genus (Coleoptera: Carabidae: Harpalini).

ABSTRACT—BALL, GEORGE E. (Department of Entomology, University of Alberta, Edmonton, Alberta, Canada). This genus (type species *Harpalus hebescens* Bates) is related to *Trichotichnus* Morawitz, and contains seven species, of which three are new: *lectocolus; trochotrichus;* and *marmoreus.* A new name, *schaefferi,* is proposed for the junior primary homonym, *Harpalus iripennis* Schaeffer. Criteria for ranking are discussed. These species are confined to an area including the mountains of Oaxaca, the eastern portion of the trans-volcanic belt, the Sierra Madre Oriental, and the coastal plain in northeastern Mexico and extreme southeastern Texas. It is suggested that this genus is a derivative of a stock which invaded Mexico from the north in pre-Miocene time.

DESCRIPTORS: Coleoptera; Carabidae; *Aztecarpalus;* new genus; keys; new species; Mexico.

(3.0023)

Neotropical Dryopoids. II. *Elmoparnus mexicanus*, sp. n. (Coleoptera, Dryopidae).

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INTRODUCTION

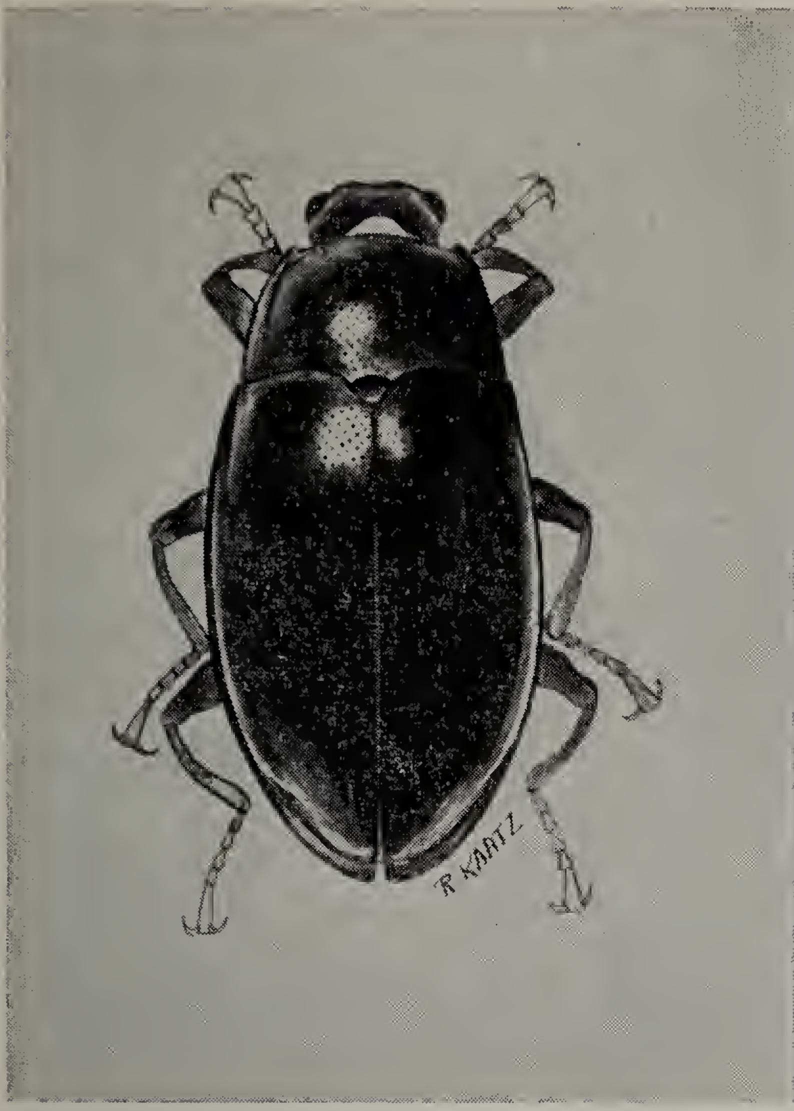
The genus *Elmoparnus* is among the least known of the family Dryopidae. In his synopsis of the genus, Hinton (1940) listed only two species, *E. brevicornis* Sharp (1882), known from but two specimens collected in Panama, and *E. glaber* Grouvelle (1889), known from a few specimens taken in Venezuela. This paper describes a third species based upon a single female specimen taken in southeastern Mexico. Other beetles collected at the same time from the same small mountain torrent include representatives of the dryopoid genera *Psephenus, Helichus, Limnichus* (?), *Phanocerus, Elsianus, Austrolimnius, Cylloepus, Heterelmis, Microcylloepus* and *Neoelmis,* as well as curculionids and larval ptilodactylids. Unfortunately, I made no record of the precise microhabitat or behavior of this specimen, noting only that the stream was somewhat polluted. I did not record the nature of the pollutant, but suspect that the stream contained obvious evidence of manure from domestic animals. It is to be hoped that future records of the genus will include information concerning its biology, as nothing has been published concerning this. Extrapolating from knowledge concerning other members of the family, I surmise that the larvae may be soil-dwellers, the adults being either riparian or aquatic. Anatomically, *Elmoparnus* seems most closely related to *Dryops.* If this similarity extends to ecology, *Elmoparnus* might well be sought on the moist bases of rocks along streams and in debris which is caught on objects protruding from the surfaces of fast-flowing streams. It is also likely that adults may be attracted to lights, since such relatives as *Dryops* and *Pelonomus* are so readily collected at lights.

Elmoparnus mexicanus sp. n.

(Figs. 1-3)

Female holotype: Length 5.6 mm, width 2.8 mm. Obovate, moderately strongly convex. Cuticle shiny, black to dark rufo-piceous; tibiae paler reddish brown; antennae and tarsi rufotestaceous. Pronotum and elytra essentially glabrous.

Head 1.2 mm wide across eyes; clothed with dense, golden pubescence. Medial portion of frons slightly depressed. On each side with a feebly elevated, bilobate ridge extending transversely from median depression to eye. Antennae 9-segmented, the first two segments with prominent golden hairs, the remaining seven with dense, fine pubescence. Clypeus with anterior margin broadly arcuate, anterior angles rounded; sides and basal three-quarters densely covered with prominent golden hairs, but apical quarter glabrous, translucent reddish brown. Labrum with middle of anterior margin conspicuously emarginate; anterior angles broadly rounded; on each side with long, erect, golden hairs; anterior margin with a dense row of short hairs; with a glabrous area occupying middle one-third just behind anterior margin.



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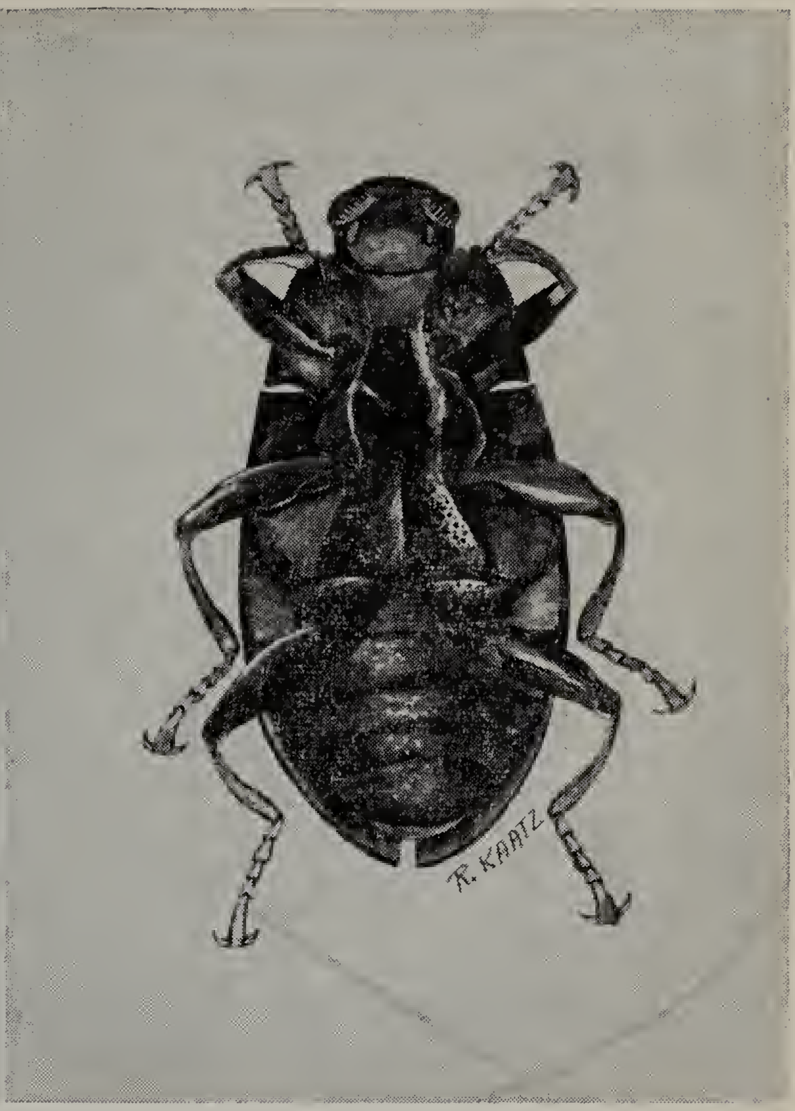

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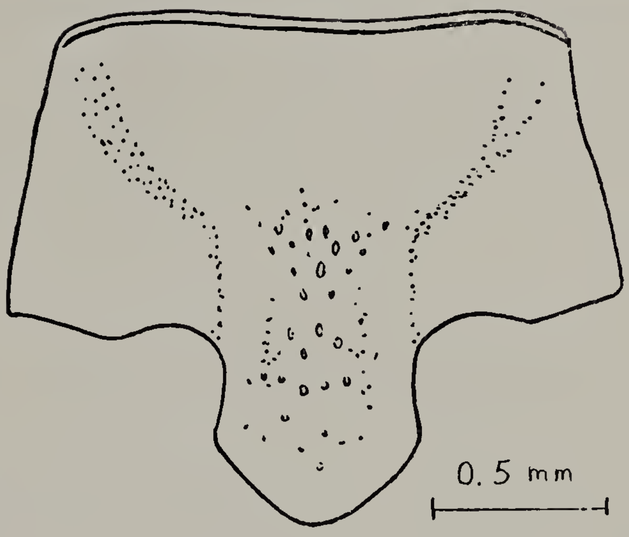

Fig.1. *Elmoparnus mexicanus* sp. n., dorsal aspect of female. Length 5.6 mm.
Fig. 2. *Elmoparnus mexicanus* sp. n., ventral aspect of female.
Fig. 3. *Elmoparnus mexicanus* sp. n., prosternum, ventral aspect.

Pronotum 1.4 mm long, 2.3 mm wide at base, and 1.5 mm wide at apex. Sides slightly arcuate, feebly sinuate before apical angles, which are produced and deflexed. Lateral edges narrowly margined. Sublateral carinae low but distinct, the inner sides sharp; extending from base nearly to apex; feebly and rather evenly diverging so that at apex they are only about one-third as far from lateral margins as at base. Surface smooth and polished, evenly convex; disk with punctures distinctly smaller than facets of eyes and usually separated by two to four diameters; toward base and sides punctures become finer and sparser.

Scutellum relatively flat, subtriangular with rounded sides, 0.25 mm long and 0.35 mm wide; surface smooth and punctate like adjacent parts of pronotum.

Elytra 4.0 mm long, 2.4 mm across humeri, and 2.8 mm wide at broadest point, which is near basal one-third. Humeral angles slightly produced anteriorly. Lateral margins feebly and narrowly explanate, interrupted at apical fourth by a densely pubescent depression. Surface smooth and polished, rather evenly convex; without striae; punctation very much like that of pronotum.

Prosternum 1.4 mm long, the prosternal process 0.6 mm long and 0.6 mm wide; at about anterior two-fifths deflexed and laterally expanded to accommodate withdrawn head. Median portion shallowly depressed posterior to deflexed region. Prosternal process widest just posterior to coxae, narrowing gradually rather than abruptly, and without a median projection externally visible (Fig. 3). Surface rather similar to that of pronotum, but with punctures more crowded in region near deflexion. Metasternal disk with surface also similar to pronotum; median longitudinal line very fine and feebly impressed, obsolete in anterior fourth.

Abdomen with first sternite feebly rugose near lateral margins. All portions of sternites tomentose to densely pubescent except medial portion of first sternite, which is sparsely pubescent, and apical five-sixths of median third of last sternite, which is sparsely pubescent to almost glabrous. Apical margin of last sternite with a slight median notch.

Type: A unique female in the Stovall Museum of Science and History, Norman, Oklahoma. MEXICO: North of Rayon in the state of Chiapas, on December 6, 1966, from a small cataract at an elevation of about 4,000 feet.

Comparative notes.—This is the largest species yet described, being 5.6 mm long as compared with *E. glaber* which is 5.0 mm and *E. brevicornis* which is only about 2.5-3.0 mm. It resembles *E. brevicornis* in having 9-segmented antennae, whereas those of *E. glaber* are 10-segmented. The anterior margin of the clypeus resembles that of *E. glaber,* differing from that of *E. brevicornis* in that it is not deeply and broadly sinuate on each side. The sublateral pronotal carinae also resemble those of *E. glaber* in being nearly complete, in contrast with those of *E. brevicornis* which are confined to about basal two-fifths. *E. mexicanus* sp. n. differs from both of the other species in lacking a slender protuberance extending from the apex of the prosternal process.

Key to the Species of *Elmoparnus*

1. Sublateral pronotal carinae confined to basal two-fifths—(PANAMA) .... **E. brevicornis Sharp 1882**
   Sublateral pronotal carinae nearly complete 2

2. Antennae with 10 segments; middle region of first abdominal sternite longitudinally rugose; prosternal process abruptly narrowed and parallel behind coxae, forming a slender apical protuberance—(VENEZUELA) .... **E. glaber** Grouvelle 1889
   Antennae with 9 segments; middle region of first abdominal sternite not rugose; prosternal process (Fig. 3) without slender apical protuberance—(MEXICO) .... **E. mexicanus** sp. n.

ACKNOWLEDGEMENT

Figs. 1 and 2 are from paintings made by Ramona Kaatz, who is now Mrs. Carlos Garcia.

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DESCRIPTORS: Coleoptera; Dryopoidea; Dryopidae; *Elmoparnus;* new species; description; key; Neotropical; Mexico.

ABSTRACT—BROWN, HARLEY P. (Zool. Dept., Univ. Okla., 730 Van Vleet Oval, Norman, Oklahoma 73069, U.S.A.). Neotropical Dryopoids. II. *Elmoparnus mexicanus,* sp. n. (Coleoptera, Dryopidae). Coleop. Bull. A new species based upon a single female specimen is described from a small mountain stream near Rayon, Chiapas, Mexico. The holotype is in the Stovall Museum of Science and History at the University of Oklahoma, Norman. Dorsal and ventral aspects of the specimen are figured, and a key separating the three known species of *Elmoparnus* is presented. *E. mexicanus* sp. n. differs from the other species in being larger, in lacking a narrow extension at the apex of the prosternal process, and in other details.—Author.

BOOK NOTICE

In 1969, Carl H. Lindroth published Part 6 of the Ground-Beetles of Canada and Alaska. With this volume the descriptive part of the series is concluded. Included are the tribes Chlaeniini, Lebiini, and related ones. Part 1 which will contain an introduction and keys to the genera is yet to appear.

Part 6, as are the other volumes, is available from the Entomological Society of Lund, Zoological Institute, University of Lund, Lund, Sweden. The price of this part is 50 Swedish crowns which at the current rate of exchange is $9.66. N.M.D.

(3.0026)

Notes on a Rare Beetle, *Cerophytum pulsator* Hald.

N. M. DOWNIE

On May 3, 1970 while sweeping herbage and flowers under sugar maples in partially open woods in the extreme northeast sector of Tippecanoe County, Indiana, I came across a very interesting beetle. To the naked eye it seeemed to be some sort of a dryopid or anobid. Attempts to key out the beetle lead to nothing but frustration. Several times in the course of the summer I would take out the specimen, look at it, and give up again. On a rainy September afternoon Ross Arnett took up the challenge and after a rather long struggle decided that we had a male of *Cerophytum pulsator* Hald., one of the two known North American species of the family Cerophytidae, the so-called Rare Click Beetles. The only record that we have of the occurence of this species is given by Horn (1886) who states that it occurs from Pennsylvania to Illinois to North Carolina and is very rare.

Our single specimen is a robust black beetle 5.5 mm. in length. (Horn states that they are 7-8.5 mm. in length.) The palpi and tarsi are ferruginous, the pronotum is much broader than long with the sides strongly arcuate in front and slightly convergent behind, the surface rather densely covered with yellowish pubescence, and with rather coarse and dense punctures. The surface of the elytra is finely, densely punctate and slightly rugose giving it a rather dull appearance and has striae of rather close deep punctures. The antennae are strongly pectinate (those of the female according to Horn being serrate). Beneath the prosternum is lobed anteriorly, the coxae are round and separate, the metafemoral plates absent, the trochanters large, that of the hind legs being almost as long as the femora, the tarsal formula 5-5-5 with the first segment as long as the next four combined, and all are densely pubescent beneath with the claws pectinate on the basal half.

REFERENCE

HORN, G. H. 1886. Monograph of Eucneminae. Trans. American Ent., 13, pp. 5-58.

Descriptors: Coleoptera; Cerophytidae; collecting data and description; Indiana.

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STAPHYLINIDAE: Currently beginning study of taxonomy and morphology of larvae and adults of the Staphylinid subfamily Leptotyphlinae. Would like to borrow specimens in this group from North America primarily, but would welcome material from Central or South America. J. F. Cornell, Ass't Prof. of Biology, Appalachian State University, Boone, N. Car. 28607.

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CICINDELIDAE: Interested in obtaining specimens of Cicindela trifasciata peruviana from Peru and Ecuador. Will exchange for other Chilean species. Luis E. Pena, G.P.O. Box 2974, Santaigo, Chile.

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LIMNEBIIDAE: Revising the genus *Ochthebius* for North America. Desire material mounted or in alcohol. F. E. Wood, Dept. Ent., Univ. of Md., College Park, Md. 20742.

Compiling a check-list of the beetles of Clark Co., Nev. I would like to correspond with Coleopterists who have collected in southern Nevada. B. W. Miller, Dept. of Biol., Univ. of Nev. at Las Vegas, Las Vegas, Nev. 89109.

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THE

COLEOPTERISTS

BULLETIN

A QUARTERLY JOURNAL DEVOTED
TO THE STUDY OF BEETLES

VOLUME 25, 1971

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REVIEW OF *SCYPHOPHORUS* (CURCULIONIDAE: RHYNCHOPHORINAE)

Patricia Vaurie

American Museum of Natural History
Central Park West at 79th St., N.Y., N.Y. 10024.

Abstract

A summary is presented of distributional, synonymical, and ecological data on the two species of the New World genus *Scyphophorus*, with distinguishing characters of the genus and species, and the first known illustrations of the genitalia.

There are only two species in the New World genus *Scyphophorus*. One (*acupunctatus*) is the sisal weevil which is economically important and which has been carried accidentally in *Agave* from the New World to many parts of the Old World (Hawaii, Borneo, Java, Australia, Africa). The other species (*yuccae*) feeds on *Yucca* plants in the southwestern United States and in Baja California. Both species are black, fully winged, without scales or dorsal hairs; they are rather flattened beetles, fairly robust, usually from 10 to 19 mm. long, with long beak and pronotum, and inconspicuous sexual dimorphism. As in other Rhynchophorini, they have elbowed antennae and an exposed pygidium. At first glance they could readily be mistaken one for the other, but in reality they differ in more ways than do some genera.

As far as I know, the specific and sexual differences of these species have not been recorded previously, nor have the genitalia been illustrated. In fact, since the days of LeConte and Horn (1873, 1876), there has been no taxonomic review of the genus except for that of Champion (1910) which included *acupunctatus* only.

The genus was proposed by Schoenherr (1838) for 3 species of Gyllenhal. LeConte (1857) and Horn (1873) each added a species, but in 1876 LeConte acknowledged that there were only two valid species.

The species seem most closely related to those of the neotropical genera *Foveolus* Vaurie and *Metamasius* Horn, but they can be differentiated from them (and from those of the 16 other genera of Rhynchophorinae in the Western Hemisphere) by 3 characters. These may be found singly in species of allied genera but not all 3 in conjunction. They concern the club, the tarsi, and the genitalia. The spongy apex of the club is either retracted within the corneous part, or visible as only a feebly carinate line. The soles of the dilated third tarsal segments are glabrous except for a uniform fringe of dense, stiff hairs along the extreme apical border (Fig. 11). The long apodemes of the male genitalia are not forked and they are articulated by a membrane to the base of the aedeagus (Fig. 9, 10); a lateral line divides the dorsal and ventral surface of the aedeagus. The styli of the female genitalia emerge from narrow stalks, giving the appearance of one stylus on top of another (Fig. 5-8). It is interesting that the aedeagus found in *Scyphophorus* resembles, of the many rhynchophorine genera I have examined for this character, only that of the monotypic *Paradiaphorus* of South America and *Sphenophorus abbreviatus*

Fabricius of Europe. The female genitalia resemble also those of *abbreviatus.*

Approximately 1300 specimens have been examined, chiefly of the more abundant and widespread *acupunctatus,* as well as the types or designated lectotypes of 3 of the 6 described forms.

ACKNOWLEDGMENTS

I thank the following individuals and institutions for the loan of specimens: C. Bordon, Caracas; C. W. O'Brien, Lubbock, Texas; B. Rotger, Pagosa Springs, Colorado; Museu de Zoologia, São Paulo; Zoologische Staatssammlung, Munich; Museum G. Frey, Munich; Instituto de Biologia, Universidad Nacional, Mexico City; University of Kansas, Lawrence; and California Academy of Sciences, San Francisco. During the past few years specimens were examined at the Field Museum, Chicago; the Museum of Comparative Zoology, Cambridge; the University of Michigan, Ann Arbor; the American Museum of Natural History, and the museums in Berlin, Copenhagen, London, Paris, and Stockholm.

ECOLOGY

The earliest association of the species of *Scyphophorus* with their host plants is by Horn (1873) for *yuccae.* In 1881 and 1886, Dugès described and figured the larvae and pupae of *acupunctatus,* now known as the sisal weevil, and listed its food plants as the maguey or century plant, *Agave mexicana* and *A. cubensis.* In the latter he found larvae, pupae, and adults together. Champion (1910) added *A. americana* and *Furcroea tuberosa* to the list from data on specimens collected by Biolley in Costa Rica. In the British Museum he found also a specimen labeled "bred in greenhouse, Windsor, 1891." Anderson (1948), in his studies of larvae from Arizona and Mexico, reported as host plants *Agave, Dasylirion,* and mescal[1] (*Lophophora*). Additional hosts, *A. atrovirens, attenuata, ferdinandi-regis, lecheguilla,* and *shawii,* were listed in a bulletin of the California Department of Agriculture (1959) in which was reported also a new host, the dragon tree (*Dracaena draco*). George W. Schwegel, an inspector in San Diego County, California, found heavy damage by larvae and adults to the roots and trunks of this tree, as well as to various *Agave* plants at Quail Park, Encinitas, San Diego County. Still another new host is soapweed (*Yucca glauca*) from which Charles W. O'Brien collected 24 adults in June, 1964, at State Lake, Logan County, Kansas. The only specimen reported from Arkansas (Crawford County) was on *Yucca.* In the southeastern United States, a specimen was collected in 1953 at Cape Sable, Florida, on the flowers of sisal (*Agave sisalana*) by E. L. Sleeper (1957).

---

[1] This host record is probably erroneous since the common name "mescal" refers to several species of *Agave* from which alcoholic beverages (i.e. tequila, pulche, and mescal) are made. The confusion probably results from the fact that *Lophophora* (peyote) contains the drug mescaline, although the plant is not called "mescal". *Lophophora* is also an unlikely host because it is a member of the family Cactaceae, whereas all other hosts listed above are Liliaceae.—Editor.

This plant was introduced in 1840 to the Florida Keys and to the Everglades; Sleeper said his specimen may have come in some sisal plants from Yucatan.

In the Eastern Hemisphere, specimens in the British Museum from Java "attacking *Agave sisalana*" and from Tanga, Tanganyika from the same plant show how the weevil follows its host. At present, according to Materu and Hopkinson (1969:78), "the Sisal Weevil . . . is the main insect pest of sisal in East Africa . . . it has now spread inland to within 50 miles west of Arusha in Tanzania and the Voi area of Kenya."

In Hawaii the first specimen of *acupunctatus* was found in Honolulu. As reported by Swezey (1927), the weevil was seen by F. Muir in 1918 " . . . crawling on a window sill of the lavatory in the basement of the main building of the Experiment Station." Another specimen was found in June 1922, by T. L. Bissell " . . . in a dead sisal plant back of the U. S. Experiment Station." Zimmerman (1941:98) said the weevil " . . . is found only on the island of Oahu where it can at times be found in abundance about Honolulu boring in stems and leaves of sisal, sometimes killing the plants, and it has been found damaging *Agave mexicana*, an ornamental species." It may have been introduced into Hawaii in some ornamental plants. At the June 9 meeting of the Entomological Society of Hawaii in 1959, Mr. Bianchi exhibited an adult which he had reared from an *Agave*. This was said to be the first report of the weevil in several years and showed the " . . . remarkable persistence of the species in spite of the scarcity of its host plant."

The other species of *Scyphophorus*, *yuccae*, " . . . feeds on the *Yucca gloriosa*, on which plant it is found in the spring, at the base of the flower stalk" (Horn 1873:410). This is said to be a cultivated species. Larvae were collected in the stems of *Yucca whipplei* in October, 1886, in Los Angeles County, California (Anderson, 1948), and I have seen adult specimens collected from that plant by H. M. Graham at Tanbark Flat, Los Angeles County, in June, 1950. Bohart in April 1939, collected 2 adults from the same county "in Joshua flowers", the Joshua tree being also a *Yucca*, according to most botanists.

DISTRIBUTION

Scyphophorus acupunctatus is extremely widespread, ranging in the Western Hemisphere (Fig. 1) from the southern United States south through virtually all Mexico (including Tres Marias Islands), the larger Antilles (Cuba, Jamaica, Haiti), and Central America to northern South America. In the United States it is most abundant in Arizona, but occurs also in New Mexico, Colorado, Kansas, Texas, and California. One example is reported from farther east in Arkansas (Mt. Gaylor, Crawford County) and one from the tip of Florida (*see* Ecology above). I have also seen a male from Cleveland, White County, Georgia, in the collection of Barry Valentine, collected by L. Harris, Jr., but without host information. In South America my only records are Brazil (2 specimens), Colombia (7 specimens), and Venezuela (more than 100 specimens from Maracaibo, Merida, and the vicinity of Caracas).

In the Eastern Hemisphere *acupunctatus* is reported from Hawaii, Borneo, Java, Australia (Queensland), and eastern Africa (Kenya and Tanzania), probably traveling wherever the sisal plant grows.

Scyphophorus yuccae, on the other hand, is more restricted in its range. It is abundant in California only, and occurs in fewer numbers in Arizona (Pima County), western Texas (Brewster County), and northern Baja California (Santo Tomas). The counties in California where it has been taken are, in the north, Marin, Placer, Sonoma, San Francisco, and San Mateo, and to the south Monterey, Tulare, Inyo, Kern, Ventura, Los Angeles, San Bernardino, Riverside, and San Diego.

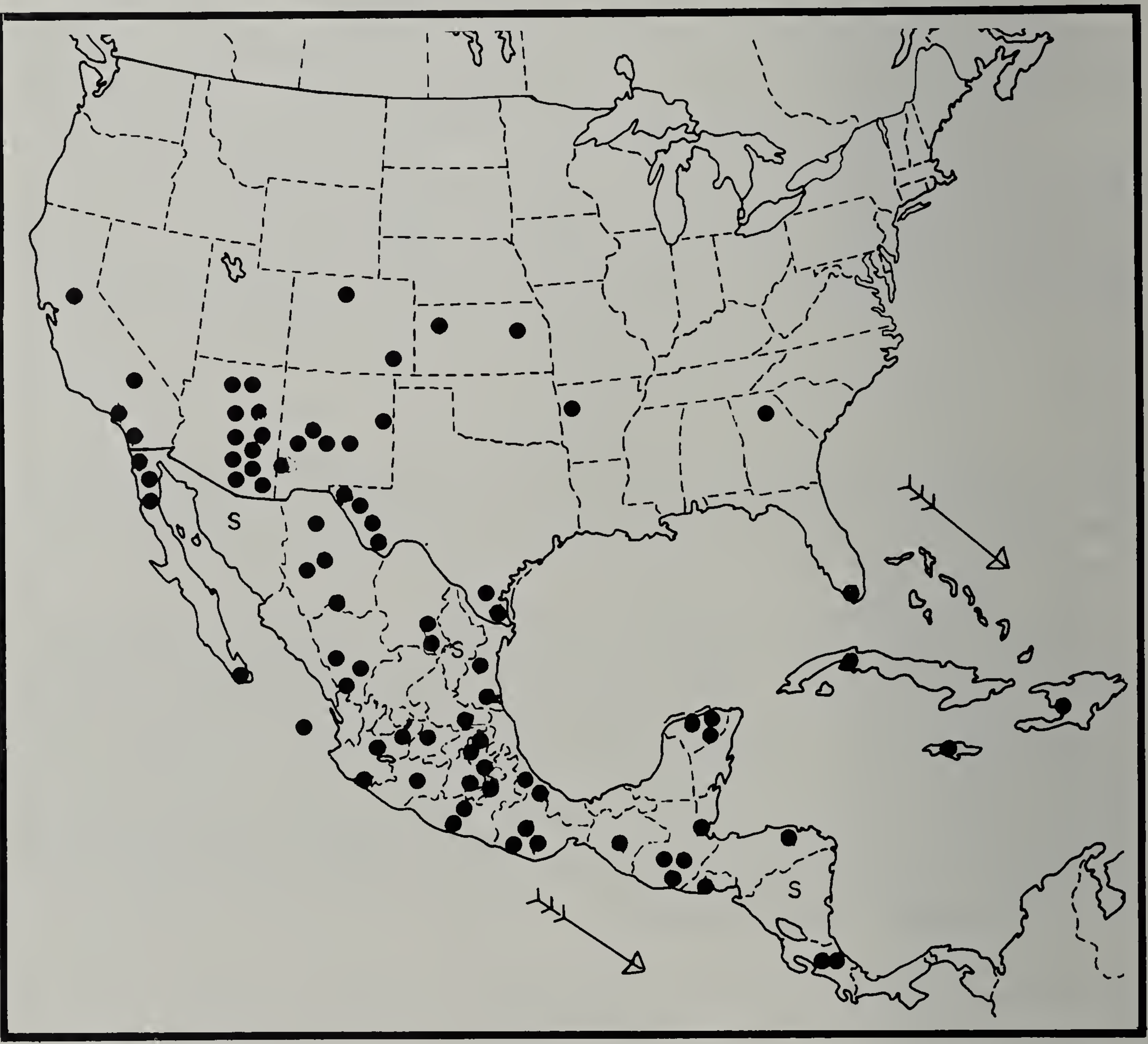

Fig. 1. Distribution of *Scyphophorus acupunctatus* in North America. Arrows point to South America, but see Distribution in the text. S = record for state or country only. Dots in Arizona represent about 30 localities.

Both species occur in northern Baja California, and have been taken together in a few of the same localities in the United States (i. e., Sequoia National Park, Tulare County, and Los Angeles County, California, also at Greaterville, southern Arizona, and Brewster County, Texas). If, as seems likely, *yuccae* breeds only in *Yucca gloriosa* and *whipplei,* its absence farther south may be due to the absence of its host plants, whereas *acupunctatus* breeds in many species of *Agave* as well as in other plants.

Another weevil of the same subfamily, but of a different tribe (Sipalini), which breeds also in *Yucca*, is *Yuccaborus frontalis*. In contrast to *Scyphophorus yuccae*, however, *Yuccaborus frontalis* has a subspecies (*sharpi*) which ranges more widely to the south, from Brownsville, Texas to Veracruz and Guerrero, Mexico.

Scyphophorus Schoenherr

Scyphophorus Schoenherr 1838:855. Type species (by original designation) *Scyphophorus acupunctatus* Gyllenhal; originally included species: *S. interstitialis* Gyllenhal and *S. anthracinus* Gyllenhal.

Eyes very large, elongate, touching below, but separated above. Mandibles pincer-like, inconspicuous. Beak nearly straight. Antenna inserted at base of beak, its funicle six-segmented. Club corneous, its spongy apical part either retracted and concave, or scarcely visible. Peduncle of postmentum elongate, flat. Pronotum without ocular lobes, as wide and almost as long as elytra. Scutellum visible. Front coxae narrowly to moderately separated; middle coxae separated by diameter of coxa. Prosternal process overlapping mesosternum. Mesepimeron as in Fig. 2 and 3. Metepisternum relatively wide, scarcely narrowing from front to rear. Femora clavate. Tibiae with outer apices dentate. Tarsus with third seg-

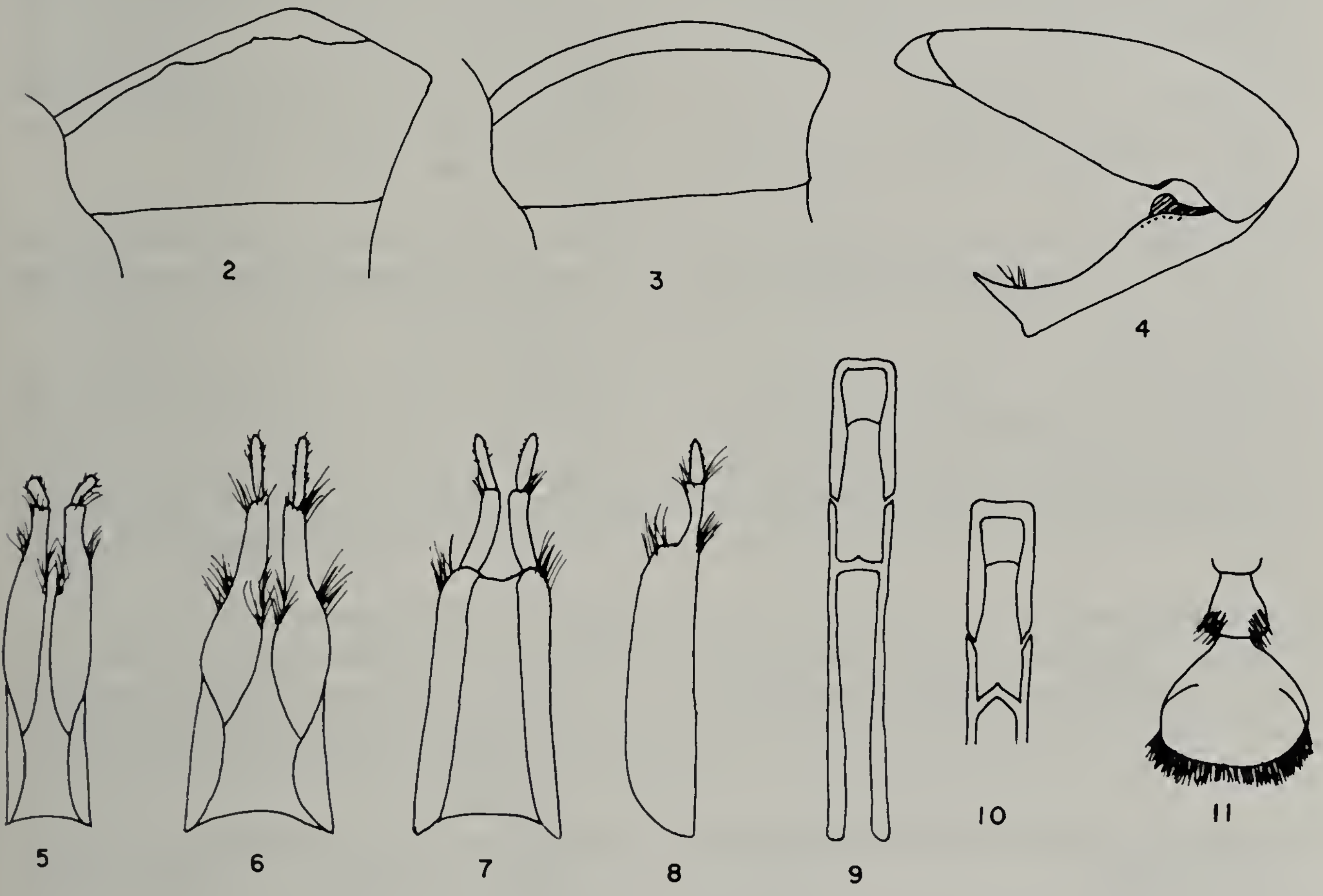

Fig. 2-11: *Scyphophorus*. 2. Mesepimeron of *S. acupunctatus* with uneven apical border. 3-5. *S. yuccae*. 3. Mesepimeron. 4. Interlocking femora and tibiae. 5. Genitalia of female, dorsal view. 6-9. *S. acupunctatus*. 6. Genitalia of female, dorsal view. 7. Same, ventral view. 8. Same, lateral view. 9. Aedeagus of male. 10. *S. yuccae*, aedeagus. 11. Third tarsal segment, ventral view.

ment dilated, bilobed, ventrally glabrous except for fringe of yellow hairs at extreme apex. Aedeagus with lateral line, and long apodemes articulated as shown in Fig. 9-10. Female genitalia (Fig. 5-8). Sexes not strongly differentiated, but males with double rows of tibial hairs longer and denser than those of females. Length, 8 to 24 mm.

KEY TO THE SPECIES OF *Scyphophorus*

Antennal club with spongy apex retracted, concave, not visible in lateral view; scutellum smaller, scarcely wider than base of sutural interval; elytra with intervals very finely, shallowly punctate; apices truncate .... *acupunctatus* Gyllenhal

Antennal club with spongy apex truncate, somewhat carinate, visible in lateral view as narrow line; scutellum larger, longer, twice as wide as base of sutural interval; elytra with intervals deeply punctate in single line; apices obliquely retracted to suture .... *yuccae* Horn

Comparison of the Species of *Scyphophorus*

Characters given in the key are not repeated.

acupunctatus (Fig. 2, 6-9)	*yuccae* (Fig. 3-5, 10-11)
Beak shorter, stouter; at base below sinuate; of male ventrally broadly sulcate and bicarinate.	Beak longer, narrower; at base below sinuate and dentate; of male ventrally smooth or faintly impressed.
Antennae with segment 2 of funicle of same length as 3; terminal segment twice as wide as long.	Antennae with segment 2 of funicle longer than 3; terminal segment less transverse.
Intercoxal space of prosternum narrower than beak at apex; of mesostermun almost as wide as coxa.	Intercoxal space of prosternum as wide as beak at apex; of mesosternum at least as wide as coxa.
Mesepimeron in front angulate, often with irregular border.	Mesepimeron in front feebly arcuate.
Pronotum rather oblong; surface slightly convex, finely punctate.	Pronotum narrowing to front; surface flat, deeply punctate.
Elytra with base broadly emarginate.	Elytra with base virtually straight.
Pygidium shorter.	Pygidium longer.
Tibiae with inner edge straight; outer apices strongly bidentate.	Tibiae with inner edge at base deeply excavated and angulate in male, feebly emarginate in female; outer apices feebly bidentate.
Femora with inner edge near apex emarginate.	Femora with inner edge near apex bluntly dentate in male, emarginate in female.
Aedeagus with sclerotized apical border narrower than lateral borders, and basal crosspiece more or less straight (Fig.9).	Aedeagus with sclerotized apical border about same width as lateral borders, and basal crosspiece arcuate (Fig. 10).
Styli of female genitalia longer, narrower (Fig. 6-8).	Styli of female genitalia shorter, wider (Fig. 5).

Scyphophorus acupunctatus GYLLENHAL

Scyphophorus acupunctatus Gyllenhal 1838:857, Mexico; type, female, in Naturhistoriska Riksmuseum, Stockholm, examined.

Scyphophorus interstitialis Gyllenhal 1838:856, St. [Santo] Domingo; lectotype, male, Santo Domingo, here designated from three original specimens from Santo Domingo and Mexico, in Naturhistoriska Riksmuseum, examined.

Scyphophorus anthracinus Gyllenhal 1838:858, Mexico; lectotype, female, here designated from two "types" in Naturhistoriska Riksmuseum.

Rhynchophorus asperulus LeConte 1857:58, Sacramento, [California]; type probably in Museum of Comparative Zoology, Cambridge.

Scyphophorus robustior Horn 1873:409, type locality omitted but supplied later by LeConte (1876), as Texas; type probably in Academy of Natural Sciences, Philadelphia.

Remarks: The above names were synonymized by LeConte (1876) except for *asperulus* which was synonymized by Horn (1873). The differences among the types of these synonyms illustrate the variability found among the 1000 or more specimens examined. Thus the pronotum may be subquadrate and the elytral intervals flat (*anthracinus*), or the pronotum distinctly longer than wide and the elytral intervals convex (*acupunctatus*); the surface may be opaque (*robustior*) or shining, the punctures small or rather coarse, the color reddish (*asperulus*) or black, the legs red or black or a combination of both. No geographic variation, however, was noted in any of these characters.

Scyphophorus yuccae HORN

Scyphophorus yuccae Horn 1873:110, "southern portion of California;" type probably in Academy of Natural Sciences, Philadelphia.

Remarks: The interlocking tibiae and femora of *yuccae* have not, to my knowledge, been noted previously. This character is more marked on the middle and hind legs than on the front legs and more marked in the male than in the female. The bases of the tibiae are emarginated or excavated to receive the rounded tubercle or the blunt tooth of the inner side of the femora.

The sexual dimorphism of the legs is not clear cut in all specimens, nor are the other secondary sexual differences notable. In general, however, the male differs from the female by having a long, deep, hairy venter; the inner side of the front tibia furnished with much longer and more abundant hairs; and the pygidium more rounded, less acuminate.

The size of specimens is from 10 to 18 mm, but I have seen an example as small as 8 mm and one as large as 24 mm.

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BOOK REVIEW

The Wasps by Howard E. Evans and Mary Jane West Eberhard. University of Michigan Press, Ann Arbor; 265 p., 122 fig.; 1970. Paperback, $3.45; library edition, $7.95.

No, we have not transferred wasps to the order Coleoptera. However, beetles play several important roles in the lives of wasps. Not only are many beetle larvae hosts for parasitic wasps of several groups, but there are beetles which are parasitic and predaceous on wasps.

Parasitic wasps of the families Scoliidae and Tiphiidae are fairly well known as enemies of Coleoptera larvae found in soil and rotting wood. especially the white grubs (Scarabaeidae). Less well known is a subfamily of Tiphiidae (the Methochinae) which attack larvae of Cicindelidae in their burrows, stinging them, laying their egg, and sealing off the burrow. Two of the 9 subfamilies of Sphecidae (Philanthinae & Crabroninae) also utilize Coleoptera as prey.

One of the chapters is entitled "Beetles as enemies of wasps," and it discusses representatives of 5 beetle families. Carabidae are mentioned as minor predators; Cicindelidae have been observed stealing prey; a species of Cleridae feeds on wasp larvae in cells in wood; but the most significant are the Rhipiphoridae and Stylopidae that are wasp parasites.

The book is well illustrated with line drawings and numerous photographs. This is another of the fine books from the pen of Howard Evans, an excellent entomologist as well as a prolific writer. I am sure that Fabre would be astounded with the amount of behavior studies now being conducted on the Hymenoptera. Surely beetles are equally interesting subjects and offer a nearly wide open field for investigation. It is lamentable that a good general biology, such as *The Wasps*, is not available for more orders of insects--especially the Coleoptera. (R. E. Woodruff)

REVIEW OF *BLEPHARIDA* CHEVROLAT (CHRYSOMELIDAE: ALTICINAE) IN AMERICA NORTH OF MEXICO

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Abstract

Blepharida dorothea, a new species, is separated from *B. rhois* (Forster). The name *B. rhois* now applies to the species with striped elytra, while the elytra of specimens of *B. dorothea* are mottled. *Blepharida dorothea* occurs from New Jersey to Colorado and south to Florida and southern Arizona. The main range of *B. rhois* is more northerly.

The genus *Blepharida* Chevrolat is the sole representative of the Blepharidini in the United States and Canada. This genus has heretofore been represented by only 1 species in this area, *B. rhois* (Forster). This is quite a variable species with elytral markings varying from vittae to mottled areas.

Hicks (1955) while working only with specimens from the Canadian National Collection was able to separate the specimens into 2 groups. The first, which had a more northern distribution, had the elytra always more or less vittate; while the second, which had a more southern distribution, had the elytra blotched or mottled. Hicks also noted that there were differences in the coloration of the antennae segments between the 2 forms.

I have seen nearly 1000 specimens from many collections and localities throughout the United States and Canada. In addition to the differences noted by Hicks, I have found differences in the lengths of antennae segments, differences in size and distribution of punctation on both the pronotum and elytra, and differences in the shape of the male genitalia. The range of the vittate form is also much increased from that known to Hicks. I feel that there are sufficient differences involved and that there are 2 species present. The name *B. rhois* is now restricted to the striped species, the mottled species being new. For the sake of clarity, the genus and *B. rhois* are redescribed for comparison purposes along with the new species.

BLEPHARIDA Chevrolat

Blepharida Chevrolat, 1837. *In* Dejean, Cat. Col., 3rd ed., p. 418.

Chevrolat, 1842:606; Rogers, 1856:29, Crotch, 1873:57, Chapuis, 1875: 25, 32; Jacoby, 1885:385; Horn, 1889:167; Blatchley, 1910:1206-07; Duchett, 1920:116, 144; Leng, 1920:299; Heikertinger and Csiki, 1940:418-22; Arnett, 1963:936.

Type species of Genus. Chrysomela rhois Forster, 1771:21 (Designated by Chevrolat, 1842:606).

Description of Genus. These are small to moderate sized beetles; broadly oval to elongate oval, very convex, with the elytra either mottled or vittate, and the pronotum usually immaculate.

Head: oval, free, inserted in pronotum to posterior edge of eyes; frontal tubercles usually flattened; fovea very small or absent; apex of mandible broad; maxillary palpi moderate; eyes moderate in size; antennae 11-segmented, short, extending only to anterior one-third of elytra, middle segments not broad or flat; interocular distance greater than one-half width of head.

Thorax: pronotum rectangular, widest near base, narrowed in front; front edge entire; without distinct impressions; usually immaculate; scutellum triangular; prosternum quite wide between coxae, procoxal cavities closed.

Legs: procoxae widely separated; claws bifid; metatibia bisulcate on outer face; apical spur of metatibia with a single point; first metatarsal segment less than one-half length of tibia, approximately equal in length to segments 2 and 3, distal segment not swollen.

Elytra: oval; wider at base than pronotum; punctures in striae, some of which reach the apex; glabrous.

Abdomen: all sterna free; pubescence pale, fine, evenly distributed.

Male genitalia: usually slightly arched dorsoventrally, ventral tip of median lobe longer than dorsal tip.

Sexual dimorphism. The females are slightly larger than the males; the first segment of the pro-and mesotarsi is more dilated in the males.

Distribution. This genus, of approximately 50 species is worldwide in its distribution. Only 1 previously described species, *B. rhois*, occurs in the United States.

KEY TO THE SPECIES OF *Blepharida* NORTH OF MEXICO

1. Elytra with red-brown vittae; antennae with segments 1 to 4 progressing from brown-testaceous to red-brown, segments 5 to 11 red-black, segments 4 and 5 subequal, longer than 3; elytra with extremely fine punctation between striae rare .... *B. rhois* Forster

   Elytra with red-brown mottling, no vittae; antennae with segments 1 to 4 red-brown, 5 to 11 red-black, segments 3, 4, and 5 progressively longer; elytra with extremely fine punctation between striae abundant and evenly distributed .... *B. dorothea* NEW SPECIES

Blepharida rhois (FORSTER)

Chrysomela rhois Forster, 1771:21. Nov. Spec. Ins.

Type locality: North America. [Neotype: Male, Westport, Massachusetts, vii/11.06, N. S. Easton Collection, MCZC; here designated].

Haltica rhois, Illiger, 1807. Mag. Ins., 6:161.

Blepharida rhois, Rogers, 1856. Proc. Acad. Nat. Sci. (Philadelphia), 8:29.

Chrysomela meticulosa Olivier, 1808. Ent., 5:531.

(Synonomy: Chevrolat, 1837:418).

Type locality: North America.

Blepharida atripennis Horn, 1895. Proc. California Acad. Sci., 6:249.

(Synonomy: Leng, 1920:299).

Type locality: Lower California. [Lectotype: Male, Lower California, ANSP].

Hubner, 1789:40; Crotch, 1873:76; Jacoby, 1885:385-389; Horn, 1889: 168; Jacoby, 1891:306; Blatchley, 1910:1208; Duchett, 1920:144; Heiker-

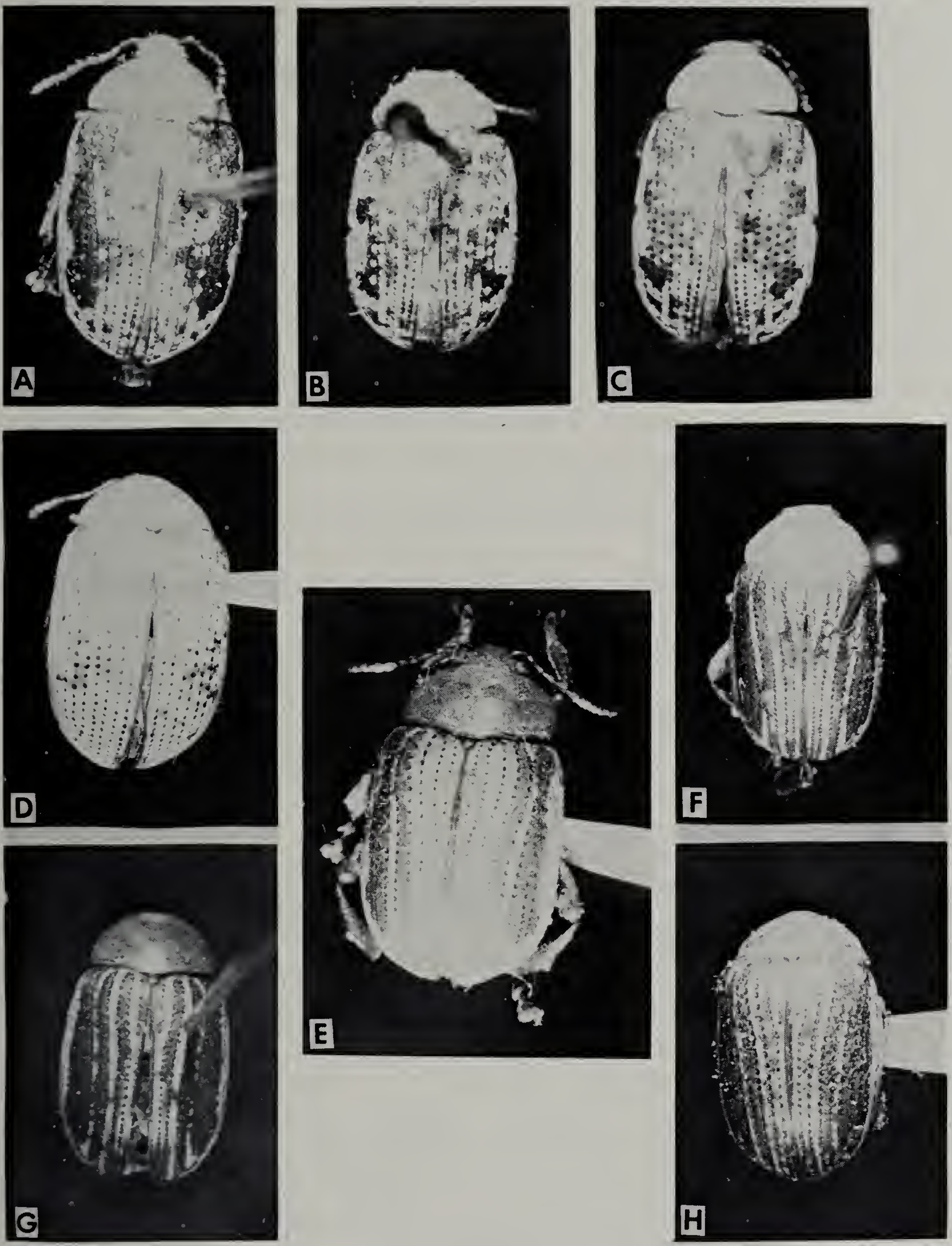

Fig. 1. A-D: Adult males of *B. dorothea*; E-H: Adult males of *B. rhois*.

tinger, 1925:50; Heikertinger and Csiki, 1940:419; Wilcox, 1954:436; Hicks, 1955:21-22; Arnett, 1963:936.

The red-brown elytral vittae will separate this species from all others in the United States and Canada.

Description of Neotype. Broadly oval, strongly convex, shining; testaceous except for red-brown elytral vittae, meso- and metasterna, abdominal sterna, and legs; total length 6.5 mm, greatest width 4.0 mm.

Head: shining; tubercles flattened, indistinct; fovea very small; punctation fine, scattered; interocular distance 1.1 mm, greater than one-half width of head; margin of labrum straight; antennae slender, extending to anterior one-third of elytra, segments 1 to 4 progressing from brown-testaceous to red-brown, segments 5 to 11 red-black, segments 4 and 5 subequal, longer than 3.

Thorax: pronotum narrowly margined, length 1.5 mm, greatest width 3.1 mm, width/length = 2.1; punctation moderate, evenly distributed and in submarginal line from lateral one-third of base to lateral one-third of front; immaculate, even, no callosities. Scutellum red-brown, triangular, shining. Elytra oval, narrowly margined, rounded apex; distinct humeral prominences; punctation coarse, arranged in 11 striae per elytron, extremely fine punctation between striae rare, most sutural extends only to anterior one-third of elytra; striae 2 and 11, 3 and 4, 5 and 8, 6 and 7, and 9 and 10 join near apex; very narrow sutural, narrow discal, narrow medial, wide lateral, and very narrow marginal red-brown interrupted vittae; length 4.7 mm, greatest width 4.0 mm.

Legs: first metatarsal segment 1½ times length of second.

Abdomen: first visible sternum longer than second.

Male genitalia: slightly arched dorsoventrally, 3½ times as long as wide; basal piece narrowed in anterior one-half.

Females. The females are slightly larger than the males.

Individual variation. Total length 6.0-7.0 mm, greatest width 3.7-4.5 mm, interocular distance 0.8-1.1 mm, pronotal length 1.1-1.6 mm, pronotal width 2.7-3.4 mm, elytral length 4.9-5.7 mm, elytral width 3.7-4.5 mm. The elytral vittae may be very narrow and short in some specimens or the elytra may be completely red-brown.

Specimens examined. MAINE: *Penobscot Co.*, Milford (1:USNM), (1:USNM); NEW HAMPSHIRE: *Hillsboro Co.*, Wilton (4:MCZC), *Rockingham Co.*, Hampton (1:MCZC); MASSACHUSETTS: *Barnstable Co.*, Bourbe (1:MCZC), *Bristol Co.*, Falls River (1:MCZC), Somerset (1:MCZC), Swansea (1:MCZC), Westport (1(Neotype):MCZC), *Franklin Co.*, Northfield (2:MCZC), *Hampden Co.*, Springfield (2:MCZC, 4:USNM), *Middlesex Co.*, Ashland (1:MCZC), Cambridge (4:MCZC, 1:USNM), Framingham (1:MCZC), Holliston (4:MCZC), Tyngsboro (6:MCZC), (1:USNM), *Nantucket Co.*, Nantucket (1:MCZC), *Norfolk Co.*, Millis (4:MCZC), Milton (1:MCZC), *Plymouth Co.*, Marion (1:MCZC), *Suffolk Co.*, Boston (1:MCZC), Dorchester (1:MCZC), *Worchester Co.*, Smithboro (2:AMNH), (1:CASC); RHODE ISLAND: *Newport Co.*, Rivirton (11:MCZC); CONNECTICUT: *Hartford Co.*, New Briton (1:USNM), *New Haven Co.*, New Haven (2:MCZC), *New London Co.*, Lyme (3:USNM), (1:USNM); NEW YORK: *Richmond Co.*, Staten Island (3:AMNH), *Suffolk Co.*, Greenwood (2:CASC), Quoque (6:USNM), Riverhead (2:USNM), (4:LACM, 1:USNM); NEW JERSEY: *Atlantic Co.*, Somers Point (1:MCZC), *Bergen Co.*, Ramsey (1:AMNH), *Camden Co.*, Camden (6:CASC), *Cape May Co.*, Cape May (9:ANSP), *Cumberland Co.*, Bridgeton (1:USNM), *Monmouth Co.*, Asbery Park (1:MCZC), *Morris Co.*, Boonton (1:USNM), *Passaic Co.*, Clifton (1:USNM), Greenwood Lake (1:AMNH), *Warren Co.*, Delaware Water Gap (1:USNM), Phillipsburg (1:CASC), (2:USNM); PENNSYLVANIA: *Allegheny Co.*, Pittsburgh (3:ICCM), *Dauphin Co.*, (1:USNM), *Delaware Co.*, Glen Olden (1:USNM), *Monroe Co.*, Water Gap (1:MCZC), *Northampton Co.*, Easton (30:CASC), *Westmoreland Co.*, Jeannette (166:ICCM), (2:CASC, 2:LACM, 9:MCZC, 3:USNM); MARYLAND: *Baltimore Co.*, Baltimore (35:CACS, 4:LACM, 5:MCZC), *Frederick Co.*, Myersville (2:USNM), *Montgomery Co.*, Glen

Echo (9:USNM), *Washington Co.*, Hagerstown (14:USNM), (1:USNM); VIRGINIA: *Fairfax Co.*, Falls Church (1:MCZC, 5:USNM), Vienna (6:USNM), (2:ANSP), *Nelson Co.*, (3:USNM), (1:MCZC, 6:USNM); OHIO: (1:USNM); INDIANA: *LaGrange Co.*, (5:MCZC); MICHIGAN: *Ingham Co.*, East Lansing (10:CASC), *Washtenaw Co.*, Ann Arbor (7:LACM), *Wayne Co.*, Grosse Point (6:MCZC); ILLINOIS: *Cook Co.*, Chicago (3:CASC); MINNESOTA: *Case Co.*, Gull Lake (2:USNM), *Houston Co.*, (1:USNM), *Washington Co.*, Lakeland (2:USNM), *Wright Co.*, Buffalo (1:USNM); SOUTH DAKOTA: *Clay Co.*, Vermillion (2:USNM), *Stanley Co.*, (1:USNM), IOWA: (7:USNM); OKLAHOMA: *Comanche Co.*, Cache (3:USNM); UTAH: *Washington Co.*, Zion Nat. Park (2:USNM); MONTANA: (2:USNM); CANADA: ONTARIO: eastern Ontario (1:CASC); ALBERTA: Medicine Hat (11:CASC, 12:MCZC).

Distribution. This species has a northern distribution extending from Maine to Virginia in the east to Alberta and Montana in the west. There are also disjunct populations in southern Utah and in Oklahoma.

Blepharida dorothea Mignot, new species

Type locality, Southern Pines, North Carolina. [Holotype: Male, Southern Pines, North Carolina, collected by A. H. Manee, MCZC].

The red-brown mottling on the elytra will separate this species from *B. rhois*.

Description of Holotype. Broadly oval, strongly convex, shining; yellow-testaceous except for red-brown mottling on elytra, meso- and metasterna, abdominal sterna, and legs; total length 6.8 mm, greatest width 4.4 mm.

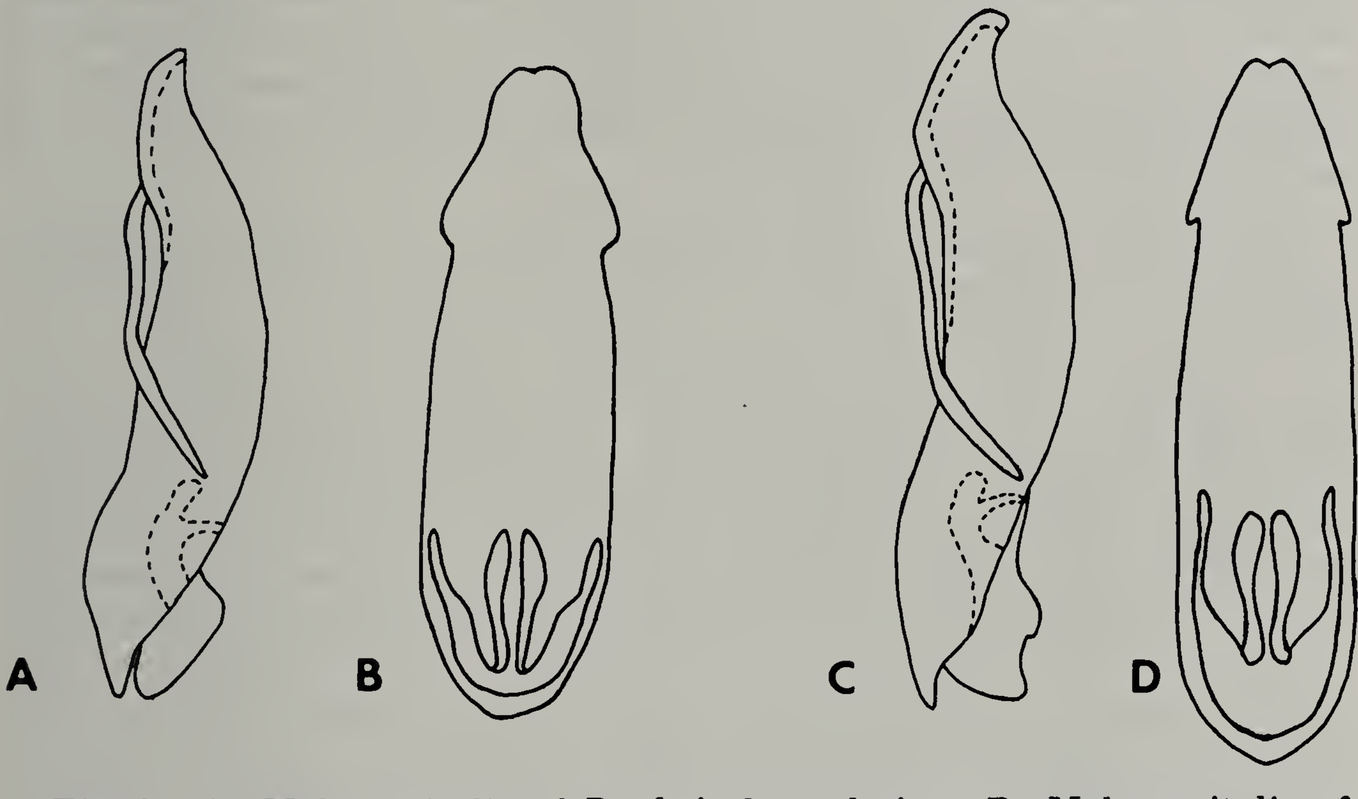

Fig. 2. A: Male genitalia of *B. rhois*, lateral view; B: Male genitalia of *B. rhois*, dorsal view; C: Male genitalia of *B. dorothea*, lateral view; D: Male genitalia of *B. dorothea*; dorsal view.

Fig. 3. Distribution of *B. rhois* and *B. dorothea*.

Head: shining; tubercles flattened, indistinct; fovea represented by 2 small impressed lines near base of antennae; punctation moderate, scattered; interocular distance 1.2 mm, greater than one-half width of head; margin of labrum straight; antennae slender, extending to anterior one-third of elytra, segments 1 to 4 red-brown, 5 to 11 red-black, segments 3, 4, and 5 progressively longer.

Thorax: pronotum narrowly margined; length 1.5 mm, greatest width 3.4 mo, width/length = 2.3; punctation fine, evenly distributed and moderate in submarginal line from lateral one-third of base to lateral one-third of front; immaculate, even, no callosities. Scutellum red-brown, rounded, shining. Elytra oval, narrowly margined, rounded apex; distinct humeral prominences; punctation coarse, arranged in 11 striae per elytron, extremely fine punctation between striae numerous, evenly distributed; most sutural striae extends only to anterior one-third of elytra, striae 2 and 11, 3 and 4, 5 and 8, 6 and 7, and 9 and 10 join near apex; red-brown mottled area covering two-thirds of elytra surface, margin red-brown; length 5.4 mm, greatest width 4.4 mm.

Legs: first metatarsal segment 1½ times length of second.

Abdomen: first visible sterna longer than second.

Male genitalia: slightly arched dorsoventrally, 3¾ times as long as wide; basal piece gradually narrowing anteriorly.

Females. The females are slightly larger than the males.

Individual variation. Total length 5.6-7.7 mm, greatest width 3.2-4.6 mm, interocular distance 1.0-1.2 mm, pronotal length 1.1-1.7 mm, pronotal width 2.5-3.6 mm, elytral length 4.3-5.9 mm, elytral width 3.2-4.6. The mottled elytral markings will vary quite extensively. Some specimens may be almost entirely pale with only a few red-brown spots. The presence of the striae may give a striped appearance to some specimens, however, the mottling rarely forms in the shape of vittae. Antennae segments 1 to 4 may be lighter on some specimens.

Specimens examined. NEW JERSEY: *Camden Co.*, Atco (17:MCZC); MARYLAND: *Prince George Co.*, College Park (1:USNM); VIRGINIA: Hampden (3:USNM), Norfolk (1:PURC, 6:USNM), *New Kent Co.*, (4:USNM); NORTH CAROLINA: *Gaston Co.*, Gastonia (1:LACM), *Moore Co.*, Southern Pines (1(Holotype):MCZC, 1(Paratype):ECMC, 2(Paratypes):MCZC), *Swain Co.*, Bryson City (1:MCZC); SOUTH CAROLINA: *Aikens Co.*, Aikens (1:MCZC), *Pickens Co.*, Clemson College (1:USNM), (1:AMHN, 4:MCZC, 2:USNM); GEORGIA: *Chatham Co.*, Savannah (1:LACM), *Glynn Co.*, Brunswick (2:USNM), *Thomas Co.*, Thomasville (1:AMNH), (1:MCZC, 1:USNM); FLORIDA: *Alachua Co.*, Gainesville (1:AMNH, 2(Paratypes):CASC, 2(Paratypes):ECMC, 1:USNM), Hawthorne (7:USNM), *Calhoun Co.*, Blounstown (1:USNM), *Charlotte Co.*, Punta Gorda (17:LACM), *Dade Co.*, Royal Palm Park (3:AMNH), *Highlands Co.*, Lake Placid (1:AMNH), *Indian River Co.*, Sabastian (3:MCZC), *Liberty Co.*, Bristol (1(Paratype):ECMC, 1 (Paratype):USNM), *Marion Co.*, Ocala (7(Paratypes):ECMC, 8(Paratypes):USNM), *Monroe Co.*, Paradise Key (1:USNM), *Nassau Co.*, Callahan (1:USNM), *Okaloosa Co.*, Valpariso (6:AMNH), *Orange Co.*, Orlando (3:CASC, 5 (Paratypes):CASC, 12 (Paratypes):ECMC, 7:LACM, 10:USNM, 5 (Paratypes):USNM), *Pinellas Co.*, Gulfport (5(Paratypes):CASC, 5(Paratypes):ECMC, 1:MCZC), Dunedin (3:PURC), *Santa Rosa Co.*, Milton (2:USNM), *Volusia Co.*, DeLeon Springs (2(Paratypes):ECMC, 2(Paratypes):MCZC), (5:AMNH, 13:CASC, 2:ICCM, 1:LACM, 4:MCZC, 1:PURC, 30:USNM); ALABAMA: *Jefferson Co.*, Birmingham (3:USNM), *Lamar Co.*, Vernon (1:USNM), *Mobile Co.*, Mobile (2:USNM), (4:AMNH); MISSISSIPPI: *George Co.*, Lucedale (2:LACM), *Harrison Co.*, Gulfport (2:USNM), *Lincoln Co.*, Brookhaven (1:USNM); LOUISIANA: *Ouachite Co.*, Monroe (1:USNM); TEXAS: *Brewster Co.*, Chisos Mts. (2:CASC, 2:USNM), *Bexar Co.*, San Antonio (2:CASC), *Cherokee Co.*, Jacksonville (2:USNM), *Dallas Co.*, Dallas (1:ANSP, 1:MCZC), *El Paso Co.*, (2:USNM), *Jasper Co.*, Kirbyville (3:USNM), *Jeff Davis Co.*, Fort Davis (1:CASC), *Pecos Co.*, Sheffield (2:CASC), *Terrell Co.*, Dryden (17:CASC), Sanderson (1:CASC), *Val Verde Co.*, (1:CASC, 1:MCZC), (7:ANSP, 3:CASC, 7:MCZC, 4:USNM); ARKANSAS: *Garland Co.*, Hot Springs (2:AMNH); TENNESSEE: *McNairy Co.*, Selmer (7:AMNH, 6 (Paratypes):AMNH, 5 (Paratypes): ECMC), *Wilson Co.*, Lebanon (2:USNM); OHIO: *Hamilton Co.*, Cincinnati (1:CASC), *Summit Co.*, Hudson (1:MCZC), (1:CASC); INDIANA: *Clark Co.*, State Forest (5(Paratypes):ECMC, 5 (Paratypes):PURC), *Harrison Co.*, (2:PURC), *Kosciusko Co.*, (1:PURC), *Lake Co.*, (1:PURC), *Putnam Co.*, (1:PURC), *St. Josephs Co.*, Mishawaka (3:PURC), *Tippecanoe Co.*, Lafayette (5(Paratypes): ECMC, 6 (Paratypes):PURC), (6(Paratypes): ECMC, 6(Paratypes):PURC), *Warren Co.*, *Greenhill* (4:USNM), (6:ANSP, 6:CASC); MICHIGAN: *Washtenaw Co.*, (3:USNM); ILLINOIS: *Calhoun Co.*, Kamperville (4:MCZC, 4:USNM), *Cook Co.*, Palos Park (1:LACM); WISCONSIN: *Crawford Co.*, Prairie du Chien (2:USNM), *Dane Co.*, *Madison* (5:MCZC), (1:CASC), *Sauk Co.*, Reedsburg (3:USNM), (2:MCZC); IOWA: *Crawford Co.*, (1:MCZC); Missouri: *St. Louis Co.*, St. Louis (1:USNM), Websters Grove (1:LACM, 4:USNM), (1:MCZC); KANSAS: *Butler Co.*, Douglas (2:ICCM), *Pottawatomie Co.*, Onago (2:CASC), *Riley Co,.* (3:USNM), *Shawnee Co.*, Topeka (13:USNM), (1:CASC, 22:PURC); OKLAHOMA: *Carter Co.*, Ardmore (3:USNM), *Cleveland Co.*, (3:CASC), *Woodward Co.*, Woodward (7:USNM); COLORADO: *Fremont Co.*, Canon City (4:USNM), *Huerfano Co.*, La Veta (1:USNM), *La Platte Co.*, Platte Canyon (1:USNM), *Larimer Co.*, Fort Collins (1:MCZC), (1:MCZC, 3:USNM); NEW MEXICO: *Colfax Co.*, Maxwell (11:USNM), *De Baca C* Alamogordo (1:ANSP), *Sandoval Co.*, Jemez Mts. (2:CASC); ARIZONA: *Coconino Co.*, Grand Canyon (1:USNM), *Navajo Co.*, Winslow (1:MCZC), *Santa Cruz Co.*, Nogales (8:CASC).

Distribution. The distribution of this species is more southern than is that of *B. rhois*. It extends from New Jersey to Florida in the east to Colorado and Arizona in the west. Hicks (1955) reported some specimens from Canada, but I have not seen any that occurred north of southern Wisconsin.

Discussion

The ranges of the 2 species overlap between 38° and 43° N. latitude. In this area, however, the elytral patterns of these species are quite distinct and thus there should be no confusion in the determination of species. North of this area, the elytral stripes of *B. rhois* become indistinct in some specimens. However, other characters persist that will separate this species from *B. dorothea*.

Both species feed on sumac (*Rhus* spp.). *Blepharida rhois* feeds on *Rhus aromatica* A.T., while *B. dorothea* feeds on *R. typhina* L., R. *copalina* L., and R. *vernix* L. In addition *B. rhois* has been collected from strawberries while *B. dorothea* has been collected on *Pinus palustris* Mill. and Brazilian pepper (*Schinus* spp.).

The names *B. stolida* (Fab.) and *B. virginica* (Frolich) have been synonomized by previous workers with *B. rhois*. However, some doubt has existed over these names for over 100 years. Olivier (1807) suggested that *B. stolida* refers to a South American species. Jacoby (1885, 1891) knew of no such species in Central America; however, this may still be a

South America species. The second name, *B. virginica*, was based on specimens from Virginia. However, the description fits neither *B. rhois* nor *B. dorothea*. Therefore, I believe that it is best to consider both *B. stolida* and *B. virginica* as *incertae sedis* rather than to doubtfully synonomize them with *B. rhois*.

A final point that should be mentioned concerns the authorship of the genus *Blepharida*. Heikertinger and Csiki (1940) and more later workers including Arnett (1963) have considered the genus *Blepharida* to have originated in Rogers' work of 1856. However, Chevrolat in 1837 in the third edition of Dejean's Catalogue lists the name *Blepharida* under which he placed 9 names and synonomized the then valid species *Chrysomela meticulosa* and *C. rhois*. Thus to Chevrolat belongs the authorship of the genus *Blepharida*.

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REDEFINITION OF THE GENERA *PELECYPHORUS* AND *PHILOLITHUS* WITH A KEY TO THE GENERA OF THE TRIBE ASIDINI (COLEOPTERA: TENEBRIONIDAE).[1]

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Abstract

Casey (1912) raised the genus *Pelecyphorus* Solier from synonymy with *Asida* Latreille, and designated *Pelecyphorus mexicanus* Solier as type-species. He considered *Philolithus* Lacordaire as a junior synonym of *Pelecyphorus*, but designated *Pelecyphorus carinatus* LeConte as type-species of *Philolithus*. Examination of adult and larval specimens revealed that the 2 type-species are not congeneric. Therefore *Philolithus* is raised from synonymy and placed in it are 31 nominal species and subspecies formerly in *Pelecyphorus*. The genus *Pelecyphorus* is restricted to its type-species *P. mexicanus*. Lectotypes of *P. carinatus* and *P. mexicanus* are designated, and the type-locality of *P. mexicanus* is restricted. Three former species of *Pelecyphorus* are placed in other genera: *Asidina semilaevis* (Horn) NEW COMB., *Stethasida laevigata* (Papp) NEW COMB., and *Notiasida lugubris* (Wilke) NEW COMB. An illustrated key is presented to the 26 genera of the tribe Asidini in North America including Mexico.

Solier (1836) described the genus *Pelecyphorus* and included in it 4 new species; *mexicanus, asidoides, foveolatus,* and *capensis.* In the following 20 years LeConte described several new North American species of *Pelecyphorus.* Lacordaire, who was corresponding with LeConte, did not believe that those species belonged in *Pelecyphorus.* He sent LeConte a key and description of the new genus *Philolithus.* LeConte (1858a) published Lacordaire's new genus and transferred all of his own species of *Pelecyphorus* into it. Since LeConte gave Lacordaire full credit for the description, the correct citation of this genus is *Philolithus* Lacordaire, 1858:18, and not 1859:157 as cited in the Leng catalogue (1920). The following year Lacordaire (1859) published an amplified description of *Philolithus.* He also transferred *asidoides* and *capensis* out of *Pelecyphorus,* leaving only *mexicanus* and *foveolatus* in that genus. With the works of Horn (1870) and Champion (1884), *Pelecyphorus, Philolithus,* and other American genera were submerged in synonymy with the Old-world genus *Asida* Latreille. Casey (1912) in revising the American genera of the tribe Asidini, restricted *Asida* to the Old-world, described many new genera, and resurrected old ones including *Pelecyphorus.* He designated *P. mexicanus* Solier as type-species of *Pelecyphorus.* Although he listed *Philolithus* as a junior synonym of *Pelecyphorus,* he designated *P. carinatus* LeConte as type-species of *Philolithus.* Casey never saw a specimen of *mexicanus,* and as a result he placed into *Pelecyphorus* species which he considered to be congeneric with *carinatus.*

Recently I have been able to examine Solier's 2 syntype specimens of *Pelecyphorus mexicanus* in the Muséum National d'Histoire Naturelle,

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[1] From a dissertation submitted in partial fulfillment of the requirements for the Ph.D. degree at the University of California, Riverside, California, 1971.

Paris, and LeConte's 2 syntypes of *Pelecyphorus carinatus* in the Museum of Comparative Zoology. They are definitely not congeneric, and in fact, they belong in rather distant groups of the tribe Asidini. *P. carinatus* has a small ligula hidden under the mentum, an extremely enlarged apical segment of the maxillary palpi, elongate-oval eyes which are not emarginate, a deflexed and broad prosternal process, and simple setae; while *P. mexicanus* has a larger and exposed ligula, relatively smaller maxillary palpi, narrower and emarginate eyes, a prominent and narrow prosternal process, and highly modified setae (Fig. 1-10, 32). Comparison of reared larvae of both species further emphasized the differences. It became clear that Casey had erred in his concept of *Pelecyphorus*. Therefore the genus *Philolithus* is herein removed from synonymy, and in it are placed most of the species formerly in the genus *Pelecyphorus*.

GENUS *Philolithus* LACORDAIRE

Philolithus Lacordaire, 1858:18; Lacordaire, 1859:157.
Pelecyphorus of Casey, 1912:105 (not Solier, 1836).

Type-species: *Pelecyphorus carinatus* LeConte, 1851:128; by subsequent designation of Casey, 1912:105. LECTOTYPE hereby designated as a male specimen in the Museum of Comparative Zoology, bearing the following labels: a gold disk, a label "Type 4532", and a third label "P. carinatus LeC. S. Felipe". A fourth label has been added reading "LECTOTYPE male *Pelecyphorus carinatus* LeConte, examined by K. W. Brown, Dec. 1967." PARALECTOTYPE hereby designated as a female specimen in the same museum bearing only a gold disk label. A second label has been added similar to the above lectotype label, but reading "PARALECTOTYPE female," etc. Type-locality: San Felipe, San Diego Co., California.

Generic description: Mentum large, transverse hexagonal to broadly cordate; notched apically; usually separated from postgenal process by a narrow space and from mandibles by a wide space (Fig. 1). Gular pedestal distinct, truncate, about half as wide as mentum. Postgenal process short, rarely extending beyond basal one-third of mentum. Ligula very small, retracted and completely hidden by mentum. Apical segment of male maxillary palpi extremely enlarged and scalene, with proximal angle acute and prolonged (Fig. 2). Apical segment of female maxillary palpi smaller and recti-triangular (Fig. 3). Eyes elongate-oval, edges almost parallel and not emarginate (Fig. 4). Tarsi with short and spiniform hairs beneath. Anterior tibiae cylindrical, moderately rugose to smooth, with the dorsal apical angle blunt to moderately acute. Prosternal process broad, deflexed and prolonged backward as a thin lobe appressed to the mesosternum; longitudinally impressed between procoxae. Basal margin of pronotum truncate, with hind angles sometimes acute but not projecting backward over elytra (Fig. 5). Width of pronotum at hind angles equal to or slightly greater than width of elytra at humeri. Elytra with marginal and outer discal carina well developed, but inner discal carina weak to absent. Pronotum and elytra with simple, inconspicuous setae, or glabrous.

Remarks: The genus *Philolithus* is a member of one of the most distinctive and well defined generic groups in the tribe Asidini. The other

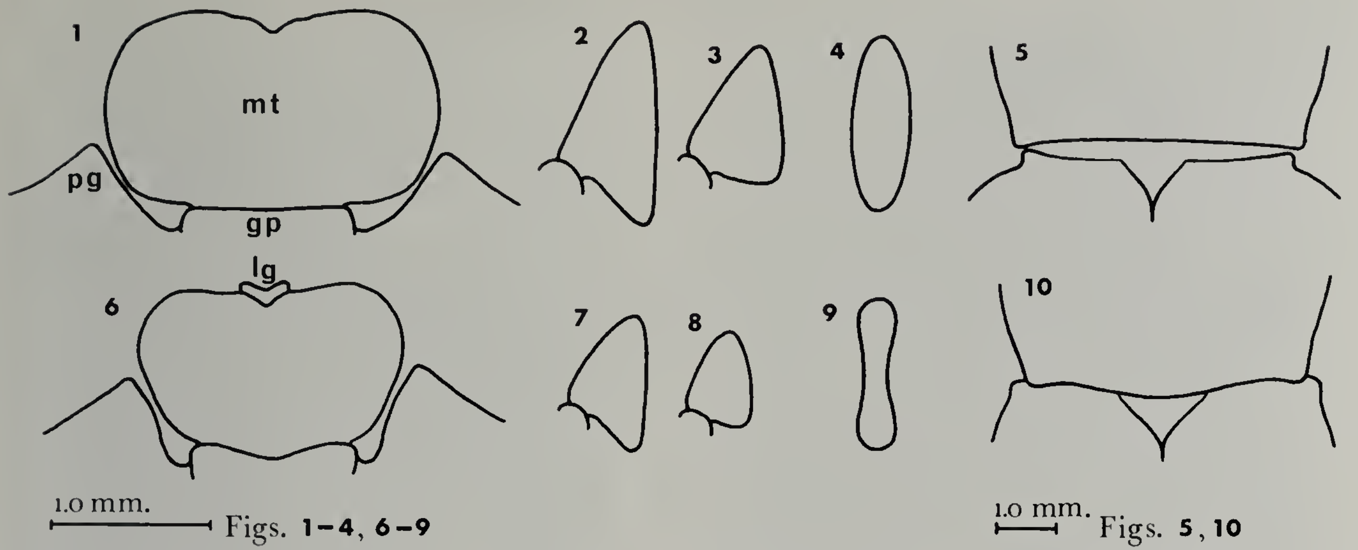


FIG. 1-5: *Philolithus carinatus* (LeConte). 1) mentum (mt), gular pedestal (gp), postgenal process (pg). 2) apical segment of maxillary palpus, male. 3) same, female. 4) eye. 5) pronotum-elytra junction. FIG. 6-10: *Pelecyphorus mexicanus* Solier. 6) mentum, ligula (lg), gular pedestal, postgenal process. 7) apical segment of maxillary palpus, male. 8) same, female. 9) eye. 10) pronotum-elytra junction.

genera in the group are *Gonasida* Casey, *Glyptasida* Casey, *Tisamenes* Champion, and *Herthasida* Wilke. Their geographic range covers almost the entire range of the tribe Asidini in North America. They occur from central Mexico to southern Canada, and from California to Kansas. Although the dorsal appearance of these genera differ markedly, they are tightly linked in sharing many characters including the following: ligula hidden by mentum, gular pedestal narrow, postgenal process short, eyes not emarginate, apical segment of maxillary palpi greatly enlarged and sexually dimorphic, and prosternal process broad and deflexed. This combination of characters distinguishes the group from all other Asidini. The key should be consulted for differences between the various genera.

Larvae of several species of *Philolithus*, *Gonasida*, and *Glyptasida* have been reared. They are remarkably similar to each other and difficult to tell apart, again demonstrating the close-knit nature of this group. They can be distinguished easily from larvae of the other genera of Asidini reared so far (*Asidina*, *Parasida*, *Pelecyphorus*, *Stenomorpha*, *Stethasida*, and *Trichiasida*) by the reduction of the urogomphi to minute tubercles. This is unusual since larvae of the asidine genera mentioned above, and in fact most Tenebrionidae, have distinct urogomphi.

There are sufficient consistent differences to indicate that the *Philolithus* group of genera must have split off early in the evolution of North American Asidini. On the other hand the divergence of the five described genera in the group was probably relatively recent, since they share many apparently derived characters in common, and are differentiated almost exclusively by dorsal characters.

List of nominal species of *Philolithus*.

For convenience I have retained Casey's 3 species groups. Although no judgement of the status of the species is made in this paper, it must be noted that few of Casey's species will stand under modern systematic concepts. A revision of the genus *Philolithus* is planned. All the species listed below were originally described in *Pelecyphorus* by their authors, or placed there by Casey (1912).

GROUP I (elytra rugose, pronotum not carinate).

abscissus (Casey, 1912:109) NEW COMB.	Arizona
aegrotus (LeConte, 1861:337)	Baja Calif.
ssp. *limbatus* (Casey, 1912:107) NEW COMB.	Baja Calif.
corporalis (Casey, 1912:107) NEW COMB.	Arizona
fumosus (Casey, 1912:109) NEW COMB.	California
morbillosus (LeConte, 1858b:74) NEW COMB.	Sonora
ssp. *pacatus* (Casey, 1912:110) NEW COMB.	Arizona
ssp. *sobrius* (Casey, 1912:110) NEW COMB.	Arizona
parvus (Casey, 1912:110) NEW COMB.	Arizona
piceus (Casey, 1912:111) NEW COMB.	Arizona
ssp. *crudelis* (Casey, 1912:111) NEW COMB.	Arizona
reptans (Casey, 1912:108) NEW COMB.	Arizona
snowi (Casey, 1912:108) NEW COMB.	Arizona
socer (Casey, 1912:108) NEW COMB.	Arizona
subtenuis (Casey, 1912:112) NEW COMB.	Arizona

GROUP II (elytra not rugose, pronotum carinate).

carinatus (LeConte, 1851:128)	California
quadripennis (Casey, 1912:113) NEW COMB.	Baja Calif.
sophistes (Casey, 1912:113) NEW COMB.	California

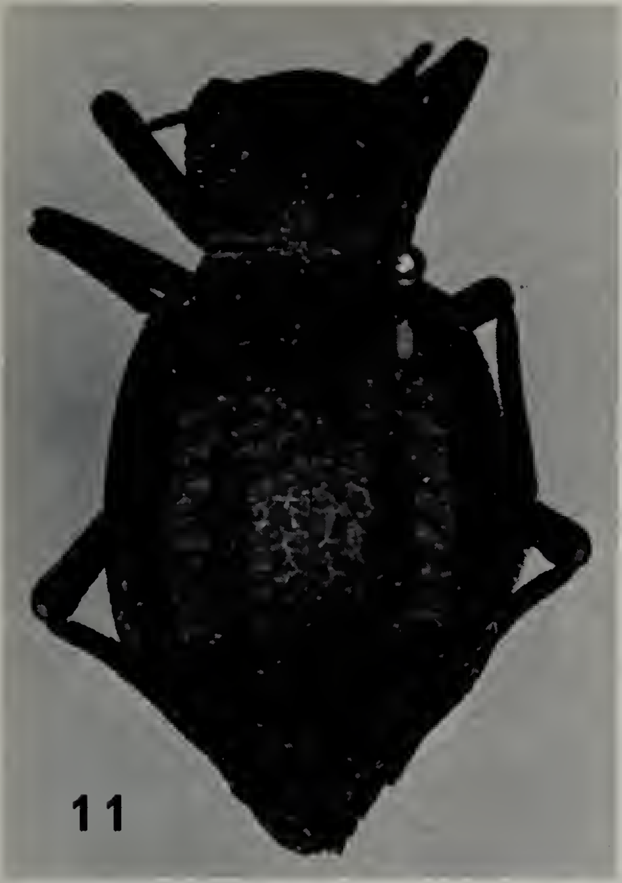
GROUP III (elytra not rugose, pronotum not carinate).

actuosus (Horn, 1870:284) NEW COMB.	California
adversus (Casey, 1912:114) NEW COMB.	Arizona
corrosus (Casey, 1912:117) NEW COMB.	Washington
densicollis (Horn, 1894:417) NEW COMB.	Washington
haruspex (Casey, 1912:115) NEW COMB.	Utah
ssp. *ellypsipennis* (Casey, 1912:116) NEW COMB.	Utah
jaegeri (Papp, 1961a:107) NEW COMB.	California
opimus (Casey, 1912:115) NEW COMB.	California
pantex (Casey, 1912:116) NEW COMB.	Nevada
porcatus (Papp, 1961b:109) NEW COMB.	California
reflexus (Casey, 1912:114) NEW COMB.	California
rugosus (Papp, 1961a:157) NEW COMB.	California
uteanus (Casey, 1924:308) NEW COMB.	Utah

Genus *Pelecyphorus* Solier

Pelecyphorus Solier, 1836:467.

Type-species: *Pelecyphorus mexicanus* Solier, 1836:469; by subsequent designation of Casey, 1912:105. LECTOTYPE hereby designated as a male specimen in the Muséum National d'Histoire Naturelle, Paris, bearing the following labels: a green label with black border "Mexicanus", and a green disk "Pelecyphor. mexicanus Sol." with additional illegible script. A third label has been added reading "LECTOTYPE male *Pelecyphorus mexicanus* Solier. Examined by Kirby W. Brown Aug. 1968". PARALECTOTYPE hereby designated as a female specimen in the same museum, bearing a green disk "Pelecyphor. mexicanus" with additional illegible script. A second label has been added similar to the above lectotype label, but reading "PARALECTOTYPE female," etc. Type-locality: "Mexique". Such a broad designation probably contributed to Casey's confusion of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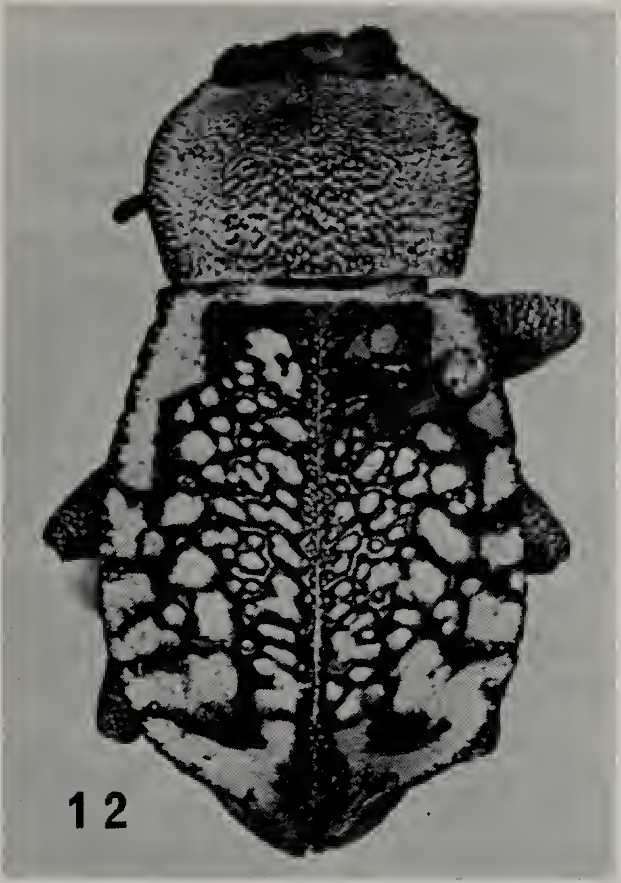
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FIG. 11: *Philolithus carinatus* (LeConte). Lectotype male in the Museum of Comparative Zoology. Length:17 mm.

FIG. 12: *Pelecyphorus mexicanus* Solier. Lectotype male in the Muséum National d'Histoire Naturelle, Paris. Length:15 mm.

Philolithus with *Pelecyphorus* as the former genus does occur in northern Mexico. The range of *Pelecyphorus* is in fact far removed from that of any species of *Philolithus*. Therefore I feel that it is important to restrict the type-locality of *P. mexicanus*. Of the specimens on hand, those from the vicinity of Chapulco are most similar to the syntypes. The type-locality of *P. mexicanus* is herewith restricted to 3 km. south of Chapulco, Puebla State, Mexico.

Generic description: Mentum large, trapezoidal to broadly cordate; notched apically; usually separated from postgenal process by a narrow space and from mandibles by a wide space (Fig. 6). Gular pedestal distinct, arcuato-emarginate, about two-thirds as wide as mentum. Postgenal process extending as far as middle of mentum. Ligula small, notched, visible, not retracted under mentum. Apical segment of male maxillary palpi enlarged and scalene, with proximal angle acute (Fig. 7). Apical segment of female maxillary palpi smaller and recti-triangular (Fig. 8). Eyes elongate, narrow, distinctly, and broadly emarginate (Fig. 9). Tarsi with short spiniform hairs beneath. Anterior tibiae flattened apically, strongly tuberculate with dorsal apical angle pronounced and acute. Prosternal process narrow, prominent, with posterior surface almost perpendicular to mesosternum, and only weakly impressed between procoxae. Basal margin of pronotum weakly bisinuate, with hind angles sometimes acute and occasionally projecting backward over elytra (Fig. 10). Width of pronotum at hind angles slightly less than width of elytra at humeri. Pronotum coarsely punctured, the punctures bearing fringed, squamose setae. Sculpture of elytral disk coarsely reticulate to carinate, with squamiform and stellate setae in depressions and on inflexed sides (Fig. 32). Depressions often coated with earthy matter.

Remarks: The genus *Pelecyphorus* is now considered monotypic for *P. mexicanus* Solier. This species is unique among the North American Asidini. The stellate setae are the most unusual feature. They are present on the sides of the elytra, and tightly packed into the depressions on the disk. Sometimes they are coated with dirt or are so tightly packed that the nature of individual setae cannot be seen. The bold and chaotic, reticulate pattern of strong, black ridges on the elytral disk is also unique. It is so variable that no two specimens are alike. Sometimes the lateral reticulations are suppressed leaving a pattern of two longitudinal carinae on each elytron. This tendency is more frequent in the populations around Cacaloapan.

Since this species is rare in most collections and the only published records are those in Champion (1884), the following records of 165 specimens are listed (Fig. 13).

Abbreviations are from Arnett and Samuelson (1969). KWBC is presently housed at PMNH. MEXICO, PUEBLA: Cacaloapan, 15 July 1965, A. R. Gillogly (5; KWBC, RESC); 18 mi. W. Cacaloapan, 15 Aug. 1965, A. R. Gillogly (11; KWBC, UCRC, RESC); 19 mi. NW. Cacaloapan, 30 July 1963, J. Doyen (25; J. Doyen Coln., KWBC); 2 km. S. Chapulco, 6600 ft., 11 Aug., 1967, K. W. Brown (1;CDAE); 3 km. S. Chapulco, 6800 ft., N. slope, Joshua tree, Acacia, 7 Aug. 1967, K. W. Brown, and M. E. Irwin (3 TOPOTYPES; INIA, KWBC, UCRC); 4 km. S. Chapulco, Joshua tree, Opuntia, 11 Aug. 1967, K. W. Brown (4; KWBC); 3 mi. E. Chapulco, 15 Aug. 1965, A. R. Gillogly (1; CNCI); km. 275, Hwy. 15, NE. of Chapulco, Yucca desert, August (2;CUIC); Tehuacán, Höge (101; British Museum, ANSP, CASC, AMNH, FMNH, MCZC); 25 mi. W. Tehuacán, 31 Aug. 1956, A. E. Lewis (3; ICCM, KWBC, USNM); 11 mi. S. Tehuitzingo, 4100 ft., Aug. (1; TAMU). QUERÉTARO: 3 mi. W. Querétaro on Hill 9, thorn scrub, August (2; CUIC). VERACRUZ: 2 mi. NW. Acultzingo, 4 July 1963, F. Coyle, and J. Beatty (2; OSUC); Coscomatepec, 5000 ft., 30 June 1948, W. W. Delquist (1; CASC); Jalapa, W. Schaus (3; AMNH, KWBC).

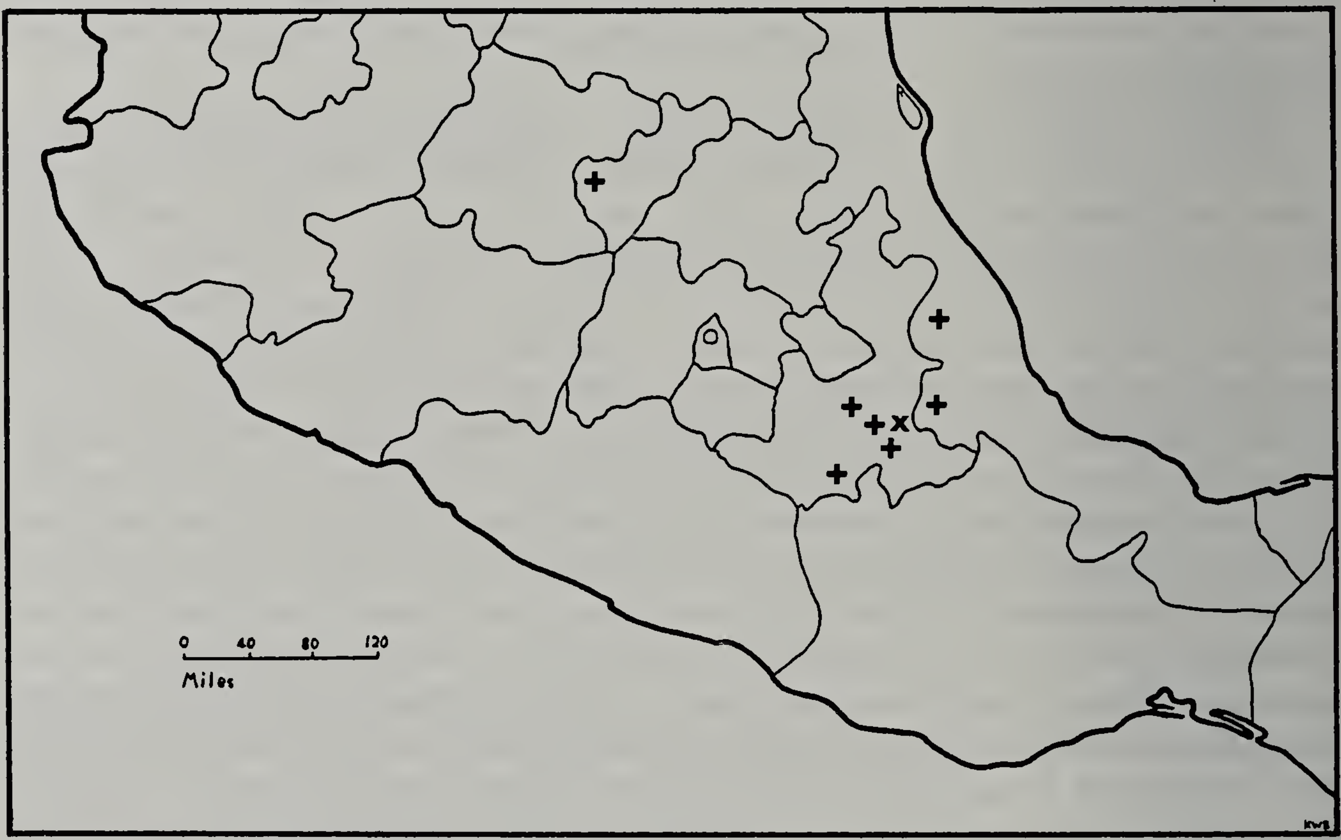

FIG. 13: *Pelecyphorus mexicanus* Solier. Distribution in central Mexico. Restricted type locality marked "x".

SPECIES EXCLUDED FROM *Philolithus* AND *Pelecyphorus*

1. *Asidina semilaevis* (Horn) NEW COMBINATION

Asida semilaevis Horn, 1870:284, plate 15, Fig. 6 (western Nevada).
Trichiasida semilaevis (Horn), Casey, 1912:182.
Pelecyphorus semilaevis (Horn), Tanner and Packham, 1962:110, Fig. 1.

Until Tanner and Packham (1962) reported collections made at the Nuclear Test Site, Mercury, Nevada, this species was known only from the unique type from "western Nevada". Except for the greater number of carinae, it closely resembles *Asidina confluens* (LeConte). In both species the ligula is visible and not retracted, and the maxillary palpi are not as large or as sexually dimorphic as in *Philolithus* or *Pelecyphorus*. The larvae of *confluens* and *semilaevis* are also similar.

2. *Stethasida laevigata* (Papp) NEW COMBINATION

Pelecyphorus laevigatus Papp, 1961a:159, Fig. 2 (southern California).

This species is clearly a member of the well defined genus *Stethasida*. It has the broad, porrect, posteriorly margined prosternal process which distinguishes this genus from all other similar Asidini (Fig. 30). It closely resembles *S. obsoleta* (LeConte).

3. *Notiasida lugubris* (Wilke) NEW COMBINATION

Pelecyphorus lugubris Wilke, 1922:269, plate 2, Fig. 18 (Mexico).

The identity of *P. lugubris* was long elusive, as none of the specimens on hand seemed attributable to this species. However it appeared to be a *Notiasida* based on the published photograph and on statements in the original description. The posterior angles of the pronotum are acute and project backward over the base of the elytra, and the humeri of the elytra are strongly curved upward. Recently I concluded that 2 specimens from Iowa State University, which until now had defied determination, were this species. They have the following data: 20 mi. W. Durango, Mexico, 31 Aug. 1957, J. C. Schaffner. They match the description and illustration well, and clearly belong in the genus *Notiasida*. The presence on the elytra of a weak metallic shine distinguishes *lugubris* from other species of *Notiasida*.

This Mexican genus presents many problems. Specimens are very rare in collections. Each of the dozen other specimens of *Notiasida* on hand appears unique to some degree. Extensive series of specimens will be needed before the species can truly be delineated. At the generic level, the separation between *Notiasida* and the *opaca* group of the genus *Asidopsis* seems quite tenuous.

KEY TO THE GENERA OF THE TRIBE ASIDINI IN NORTH AMERICA.

In order to incorporate the changes proposed in this paper, and because no existing keys include all of the Mexican genera, the following key is offered covering Mexico, the United States, and Canada. It must be pointed out that the generic classification at present is not in a satisfactory state. Many of the genera, such as *Trichiasida, Parasida,* and *Notiasida,* are not well characterized and contain mixtures of elements from other genera. Therefore some species may not key well. Those genera with minor problems of this type are marked * in the key, while those with major problems are marked **. No attempt has been made to fit in several new genera

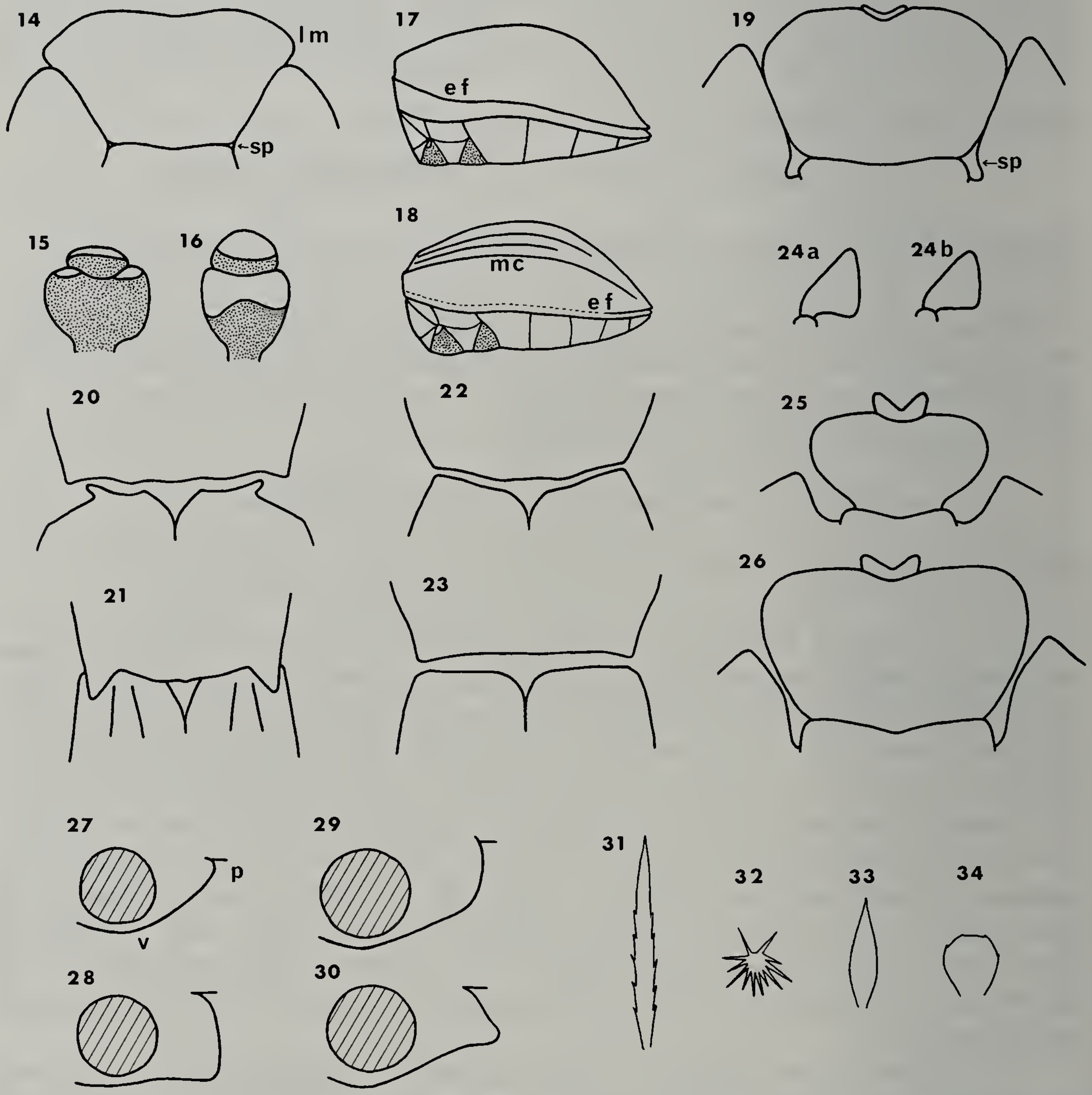

FIG. 14: *Astrotus*, mentum showing lateral margin (lm), and minute basal corner space (sp). FIG. 15-16: apical antennal segments. 15) *Astrotus.* 16) *Sicharbas.* FIG. 17-18: elytra and abdomen, lateral view. 17) *Microschatia*, showing epipleural fold (ef). 18) *Parasida*, showing marginal carina (mc) and weak epipleural fold. FIG. 19 *Zaleucus*, showing large basal corner space. FIG. 20-23: pronotum-elytra junction. 20) *Glyptasida.* 21) *Parasida.* 22) *Stenomorpha.* 23) *Megasida.* FIG. 24: *Trichiasida*, apical segment of maxillary palpus; a—male; b—female. FIG. 25-26: Mentum. 25) *Asidopsis.* 26) *Megasida.* FIG. 27-30: prosternal process, lateral view (v = ventral, p = posterior). 27) *Stenosides.* 28) *Astrotus.* 29) *Poliorcetes.* 30) *Stethasida.* FIG. 31-34: Setae of elytra. 31) *Platasida.* 32) *Pelecyphorus.* 33) *Ucalegon.* 34) *Parasida.*

which will be described in the future. However this key should be useful for the great majority of specimens which may be in collections. It is an artificial key, and some genera key out in several places if separation at a particular couplet is not precise. Note that many of the couplets require clearly visible mouthparts, not obscured by dirt or exudate. Cleaning can be done by gently teasing with a pin or brush after soaking in warm water.

1. Mentum tightly contacting postgenal process exposing at most a minute space at basal corners; mentum sometimes contacting mandibles apically; gular pedestal weakly developed or not evident (Fig. 14); mesotrochantin small to absent 2

1′. Mentum usually not or but loosely contacting postgenal process (Figs. 1, 6, 25, 26), or if tightly contacting postgenal process, a large space is exposed at basal corners (Fig. 19, sp); mentum never contacting mandibles apically; gular pedestal evident and usually well developed; mesotrochantin large 5

2(1). Antennae thickened, penultimate segment normal with 2 distinct apical tomentose spots (Fig. 15); hind angles of pronotum not projecting backwards over elytra; ligula variable 3

2′. Antennae slender, tomentose area of penultimate segment broad and coalesced into continuous band (Fig. 16); hind angles of pronotum lobiform, strongly projecting backwards over elytra; ligula often visible (1 sp.; central Mexico) .... *SICHARBAS* Champ.

3(2). Ligula always hidden; epipleura of elytra narrow from apex to base (Fig. 18); epipleural fold distinct only near cauda and weak or absent over remaining length 4

3′. Ligula visible; epipleura narrow apically, widening toward elytral base (Fig. 17); epipleural fold usually distinct over entire length 7

4(3). Mesotrochantin absent; lateral margin of mentum (Fig. 14, lm) bent inward toward mandible leaving a very narrow space; postgenal process often swollen; prosternal process usually porrect behind coxae (viewed laterally), sloping precipitously toward mesosternum (Fig. 28); sculpture of elytra rough and uneven (12 spp. and subsp.; south-central U.S., Mexico) .... *_ASTROTUS_ LeC.

4′. Mesotrochantin small but visible; lateral margin of mentum not bent inward toward mandible, leaving a wider space near apex of moderately thickened postgenal process; prosternal process deflected behind coxae (viewed laterally), sloping at an incline toward mesosternum (Fig. 27); elytra with fine anastomosing dorsal ridges (15 spp.; SW. & central U.S., Mexico) .... *_STENOSIDES_ Sol.

5(1′). Epipleura of elytra narrow apically, widening toward elytral base (Fig. 17); epipleural fold usually distinct over entire length; prosternal process porrect and prominent behind coxae (Fig. 28) 6

5′ Epipleura remaining narrow from apex to base (Fig. 18); epipleural fold very distinct near cauda and often weak or absent over remaining length; prosternal process variable 8

6(5). Segments of antennae and tarsi thick and compact; hind angles of pronotum not prolonged backward over elytra; mentum large and in close contact with postgenal process, concealing cardo 7

6′. Segments of antennae and tarsi slender and elongate; hind angles of pronotum acutely prolonged backward over elytra; mentum small and separated from postgenal process, revealing cardo (1 sp.; Ariz., northern Mexico) .. *LITASIDA* Csy.

7(3′,6). Pronotum muricate to coarsely punctate; elytral sculpture rough, uneven, not forming parallel lines (7 spp.; so. Calif., Baja Calif.) .... *PYCNONOTIDA* Csy.

7′. Pronotum smooth to moderately punctate; elytral sculpture variable, but when rough tends to form a pattern of parallel lines (6 spp.; SW. U.S., Mexico) .... *MICROSCHATIA* Sol.

8(5′). Elytra under high magnification with scattered erect, barbed setae (Fig. 31); elytra strongly lobed posteriorly; lateral margins of pronotum strongly reflexed (3 spp; Mexico, Baja Calif.) .... **PLATASIDA* Csy.

8′. Elytra glabrous or with simple, thickened, squamose, or stellate setae, but never with erect barbed setae; elytra usually not lobed posteriorly; pronotum variable 9

9(8′). Penultimate antennal segment normal, with 2 distinct apical tomentose spots (Fig. 15); pronotum not impressed medially 10

9′. Penultimate antennal segment with tomentose areas coalesced into a narrow continuous band, giving antennal apex a wholly spongiose appearance; pronotum usually impressed medially (5 spp.; Baja Calif.) .... **HETERASIDA* Csy.

10(9). Postgenal process projecting well beyond middle of mentum, often greatly thickened or swollen; mentum in tight, broad contact with postgenal process (Fig. 19); pronotum dilated laterally (1 sp.; central Mexico) .... *ZALEUCUS* Champ.

10′. Postgenal process never projecting beyond middle of mentum and not thickened or swollen; mentum not in tight, broad contact with postgenal process (Fig. 1, 6, 25, 26); pronotum variable 11

11(10′). Ligula very small, completely retracted and hidden under apical margin of mentum (Fig. 1); apical segment of maxillary palpi extremely enlarged, recti-triangular in the female (Fig. 2); scalene in the male with proximal angle acute and prolonged (Fig. 3) 12

11′. Ligula variable but always at least partially exposed and projecting beyond apical margin of mentum (Fig. 6, 19, 25, 26); apical segment of maxillary palpi usually only moderately enlarged (Fig. 7, 8, 24), but if extremely enlarged as Fig. 2 and 3 then ligula is very large and tumid (Fig. 25) 16

12(11). Tarsi with short and inconspicuous spiniform hairs beneath; elytra with distinct, though sometimes irregular carinae; pronotum variable 13

12′. Tarsi with long, fulvous, silky hairs beneath; elytra may be deeply sulcate, but not with distinct, well separated carinae; pronotum disk smooth, sides often dilated and reflexed (9 spp. and subspp.; western U.S., northern Mexico) .... *GONASIDA* Csy.

13(12). Pronotum with sides notably dilated (Mexico only) 14

13′. Pronotum with sides not or but slightly dilated 15

14(13). Dilated sides of pronotum acute, aliform; disk clothed with conspicuous fulvous, silky pubescence; elytra with straight prominent carinae, delineated by tufts of fulvous hairs; length under 20 mm. (1 sp.; central Mexico) .... *TISAMENES* Champ.
14′. Dilated sides of pronotum broadly rounded; disk coarsely punctured, not pubescent; elytra with undulating, sinuous carinae, not pubescent; length over 25 mm. (1 sp.; northern Mexico) .... *HERTHASIDA* Wilke

15(13′). Width of pronotum at basal angles at least 1/5 greater than width of elytra at humeri (Fig. 20); elytra each with marginal carina and 2 distinct, subequal discal carinae (22 spp. and subspp.; SW. Canada, W. and central U. S., northern Mexico) .... *GLYPTASIDA* Csy.
15′. Width of pronotum at basal angles subequal to width of elytra at humeri (Fig. 5); elytra each with marginal carina and only 1 distinct discal carina, the inner carina of the preceding genus poorly defined (31 spp. and subspp.; SW. Canada, W. & central U. S., northern Mexico) .... *PHILOLITHUS* Lac.

16(11′). Hind angles of pronotum distinctly prolonged backward and overlapping elytra (Fig. 21) 17
16′. Hind angles of pronotum weakly (Fig. 10) or not at all (Fig. 22,23) overlapping elytra 22

17(16). Elytra each with 2 or 3 discal ridges varying from strongly carinate and independent or latticed, to feeble and irregular; lateral margin always carinate 18
17′. Elytra lacking ridges; surfaces may be smooth, punctate, rugulose, or weakly striate; lateral margin of elytra may or may not be carinate 21

18(17). Intervals between longitudinal elytral carinae latticed or roughly sculptured; carinae may be feeble and irregular; setae variable 19
18′. Intervals between longitudinal elytral carinae canaliculate, rarely broken by 1 or 2 short, raised, transverse ridges; longitudinal carinae always well defined and regular; pronotum and elytra often with fulvous, thickened or squamiform setae (Fig. 34) (26 spp. and subsp.; SW. U. S., Mexico) .... ***PARASIDA* Csy. (part)

19(18). Elytra with confused sculpture, the ridges feeble and subequal; setae often thickened or squamiform 20
19′ Elytra coarsely clathrate, with the inner longitudinal carina more strongly developed than the outer and sometimes sharply elevated; setae if present always slender and simple (5 spp.; Mexico) .... *BOTHRASIDA* Csy. (part)

20(19). Ligula large and tumid; width of mentum at base about ½ the width at middle (Fig. 25); humeri of elytra often distinctly reflexed (7 spp; Mexico) .... **NOTIASIDA* Csy.
20′. Ligula smaller and not tumid; width of mentum at base about 2/3 the width at middle (Fig. 6); humeri of elytra planate, not distinctly reflexed (see couplet 18).. ***PARASIDA* Csy. (part)

21(17′). Mentum small, with wide space between it and postgenal process; width of mentum at base about ½ the width at middle (Fig. 25) (28 spp.; SW. Canada, W. & central U. S., Mexico) .... **ASIDOPSIS* Csy. (part)

21′. Mentum large, often contacting postgenal process; width of mentum at base about 3/4 the width at middle (Fig. 26) (11 spp.; SW. U. S., Mexico) .... **MEGASIDA* Csy. (part)

22(16′). Base of pronotum convex or convexo-emarginate (Fig. 22); hind angles of pronotum obtuse to rounded, never prominent 23

22′. Base of pronotum truncate, concave (Figs. 5, 23), or bisinuate (Fig. 10); hind angles of pronotum rectangular to acute, usually somewhat prominent 25

23(22). Apical segment of maxillary palpi greatly enlarged and sexually dimorphic, recti-triangular in the female (Fig. 3), larger and scalene with proximal angle prolonged in the male (Fig. 2); ligula large and tumid (Fig. 25); body rarely hirsute; humeri of elytra rarely prominent and reflexed; length 12-35 mm. (85 spp. & subspp.; SW. Canada, W. & central U. S., Mexico) .... **STENOMORPHA* Sol.

23′. Apical segment of maxillary palpi smaller, only moderately enlarged and often not notably sexually dimorphic, at most recti-triangular in the male (Fig. 24) 24

24(23′). Disc of pronotum and elytra with setae present, body often hirsute; ligula small, not tumid (Fig. 6); humeri of elytra usually inconspicuous and not reflected; length 10-30 mm. (20 spp.; SW. U. S., Mexico) .... ***TRICHIASIDA* Csy. (part)

24′. Disc of pronotum and elytra glabrous; ligula large and tumid (Fig. 25); humeri of elytra prominent and reflexed; length under 16 mm. (see couplet 21) .. **ASIDOPSIS* Csy. (part)

25(22′). Body with modified squamiform (Fig. 34), paddle-like (Fig. 33), or stellate (Fig. 32) setae; may be coated with earthy matter 26

25′. Body glabrous or with simple setae only; usually not coated with earthy matter 27

26(25). Surface of elytra with contrasting pattern of dark and pale colored, clustered, paddle-like to squamose setae (Fig. 33, 34); elytra each with one regular discal carina; not coated with earthy matter (1 sp.; southern Mexico) .... *UCALEGON* Champ.

26′. Elytra with only pale colored, stellate (Fig. 32), and squamiform setae, thickly packed in depressions which are often filled with earthy matter concealing setae; elytra (Fig. 12) with coarse, black reticulate pattern, lateral reticulations occasionally supressed (1 sp.; central Mexico) .... *PELECYPHORUS* Sol.

27(25′). Prosternal process (viewed laterally) deflexed (Fig. 27) or obtusely prominent (Fig. 29) behind coxae, not sharply margined posteriorly 28

27′. Prosternal process (viewed laterally) porrect and extending over mesosternum (Fig. 30), broadly lobed and sharply margined posteriorly (25 spp. & subspp.; Calif., Baja Calif.) .... *STETHASIDA* Csy.

28(27). Body clothed with short, but numerous and clearly visible, setae 29

28′. Body glabrous, or setae very inconspicuous 31

29(28). Lateral margin of elytra strongly carinate, but never tuberculate; carinate margin extending from humeri almost to apex; body with evident, small setae, but not hirsute 30

29′. Lateral margin of elytra not carinate; or if carinate then carina is tuberculate, or is weak and does not reach humeri; body often hirsute (see couplet 24) .... ***TRICHIASIDA* Csy. (part)

30(29). Prosternal process gradually declivous, deflexed, posteriorly forming a thin lobe (Fig. 27) (6 spp.; southwest U. S., Sonora, Baja Calif.) .... *ASIDINA* Csy. (part)
30′. Prosternal process abruptly declivous, prominent, posteriorly forming a thick lobe (Fig. 29) (1 sp.; central Mexico) .... *POLIORCETES* Champ.

31(28′). Elytra each with at least one distinct discal carina; lateral margin always carinate 32
31′. Elytra lacking any discal carinae; lateral margin variable 33

32(31). Elytra with independent, regular discal carinae (see couplet 30) .... *ASIDINA* Csy. (part)
32′. Elytra coarsely clathrate, the discal carinae connected by numerous, well developed, transverse ridges (see couplet 19′) .... *BOTHRASIDA* Csy. (part)

33(31′). Mentum small, with wide space between it and postgenal process (Fig. 25); width of mentum at base about ½ the width at middle (see couplet 21) .... **ASIDOPSIS* Csy. (part)
33′. Mentum large, often contacting postgenal process (Fig. 26); width of mentum at base about 3/4 the width at middle (see couplet 21′) .... **MEGASIDA* Csy. (part)

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REDEFINITION OF *PODABRUS BREVIPENNIS* LECONTE AND RECOGNITION OF A NEW SUBSPECIES (COLEOPTERA: CANTHARIDAE)[1]

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ABSTRACT

Podabrus brevipennis LeC., originally based only on micropterous females from Argentine Pass, Colorado, is redescribed with the allotype male coming from Mt. Evans, Colorado at 13,000 ft. elevation. The new subspecies *wittmeri* is based on a single macropterous male from Medicine Bow Mountains, Wyoming at 9,875 ft. elevation. It is suggested that the micropterous condition is the result of adaptation for high altitude existence.

INTRODUCTION

Podabrus brevipennis LeConte was described in 1878 on the basis of a single female specimen collected at Argentine Pass, Colorado, elevation 13,000 feet. As indicated by the name, a notable characteristic of the species was the somewhat abbreviated elytra, leaving the apical 3 abdominal segments exposed. Subsequent to his description of the species, LeConte placed representatives of 2 other species in his series of specimens. His reason for such inclusion is obscure and untenable, as noted by Fall in 1928. Three of the specimens so included were *Podabrus excursus* Fall from Utah and British Columbia. Another specimen is an undeterminable female, possibly *Podabrus punctulatus* LeConte.

I have before me 2 specimens of *Podabrus* from Mt. Evans, Colorado (a male from 13,000 feet and a female from 11,600 feet) that seem to fairly well fit the description of LeConte's type. Dr. John F. Lawrence, Museum of Comparative Zoology, kindly compared these specimens with the type and agreed that at least the female is conspecific, and he so designated on the specimen label. He was less certain about the male, probably on sexual and color differences. In May 1970, I was able to study the LeConte and Fall types. Thus I confirmed, to my complete satisfaction, the conspecificity of both specimens. Miskimen (1958) has shown that color is not reliable in some species of *Podabrus*.

I had been unable to find Argentine Pass on my highway maps of Colorado and assumed that the pass had fallen into disuse sometime after the type was collected. A letter from Mr. Robert Fink, Assistant to the Director of the State Historical Society, confirmed this: "It is probable that the old Argentine-Central narrow gauge railroad utilized the pass in its heyday; but the road proved too much for horse and wagon. It lies between Mt. Edwards and Argentine Peak and on the county line that separates Clear Creek County from Summit County." From the map sent to me, it would appear that Argentine Pass is less than 15 air miles from Mt. Evans.

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Podabrus brevipennis LeConte

Podabrus brevipennis LeC. 1878:460; 1881:48, 69; Fall 1928:93.

Black. Sides of head in front of antennae, basal half of mandibles, basal 2 antennal segments beneath, apical margins of abdominal sternites 4 and 6 narrowly testaceous. Pronotum black to black with either anterior or posterior angles or both more or less widely testaceous, the extent obscurely delimited. Apical angles of all abdominal sternites testaceous. Pubescence cinereous, becoming aureous on tibiae and tarsi. Length 8.5 to 9 mm.

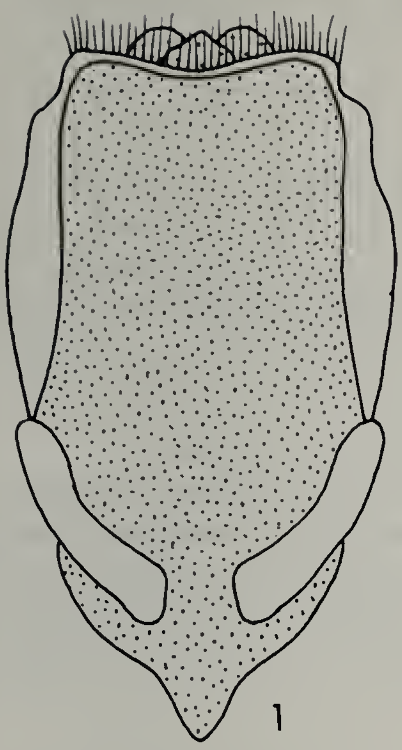
Male. Head feebly shining and finely, sparsely punctured in front of antennae, dull and rugose-punctate behind, becoming scabrose on the neck, feebly, gradually narrowed behind eyes, neck thick; eyes smaller and less prominent than usual, ocular index 75; apical segment of maxillary palpi short, scalene, vertical angle nearer apex than base, all sides arcuate; apical margin of clypeus biarcuate; antennae more widely separated than usual, stout, extending to about tips of metacoxae, second and third segments of nearly equal length, third scarcely longer than wide, length-width ratio of intermediate segments about 13:6, basal two segments shining, remaining segments dull. Pronotum transverse, wider than head, anterior margin feebly bisinuate and broadly, shallowly reflexed, anterior angles rounded and explanate, sides rather arcuate to basal third, becoming sinuate to the obtuse, feebly prominent and shallowly, narrowly reflexed hind angles, basal margin feebly bisinuate and abruptly reflexed, gutter thus formed rather broad; elevations rather high, rounded, each with a round indentation at the top, median depressed area very shallow, sculpture variable, marginal explanate or reflexed areas dull, coarsely rugose-punctate on apical and basal margins, coarsely punctured on lateral margins, elevations and median depressed area shining and moderately sparsely punctured with interspersed finer and coarser punctures, an eroded longitudinal impressed line between the elevations. Scutellum triangular, nearly as wide as long, apical angle broadly rounded, dull and finely, closely punctured. Elytra parallel sided, finely rugose basally, becoming scabrose at and beyond middle. Thorax beneath shining, finely, closely punctured. Abdomen dull, finely, sparsely punctured. All legs normal, all claws of front and middle feet narrowly cleft, appendix a little shorter than claw proper, all claws of hind feet with a short acute tooth. Male genitalia shown in Fig. 1-3.

Female: Similar to male. Sides of pronotum nearly straight and parallel from rounded anterior angles to nearly rectangular hind angles. Last abdominal sternite bidigitate medially with an arcuate indentation exterior to each digit (Fig. 5). All claws with a short, acute tooth.

Podabrus brevipennis brevipennis LeConte

Elytra abbreviated, about twice as long as their combined widths, leaving apical two or three abdominal segments exposed. Third antennal segment subcampanulate (Fig. 4), as wide as long as viewed from above.

LeConte's type, a female, Colorado Argentine Pass, 13,000 feet. Allotype male, Colorado, Mt. Evans, 12-VII-1947, 13,000 feet, Owen Bryant [California Academy of Sciences].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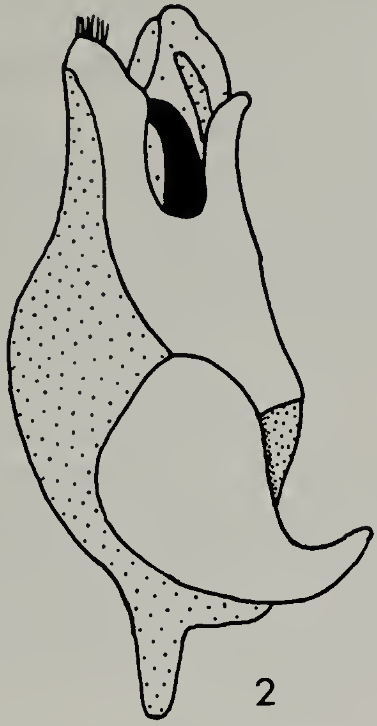
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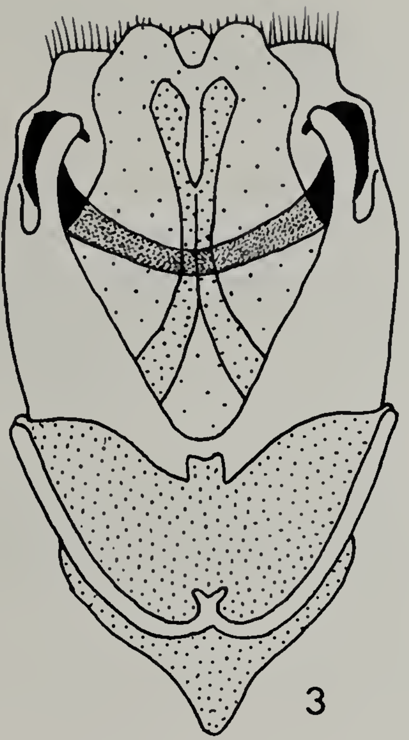
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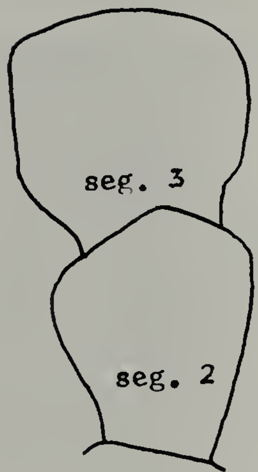

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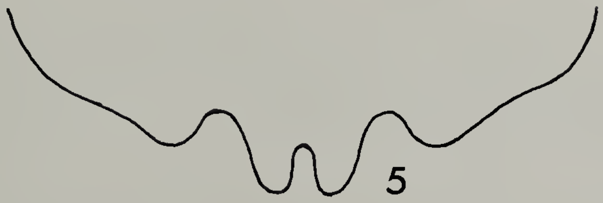
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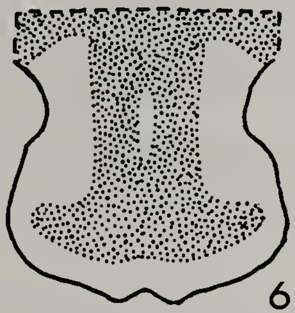
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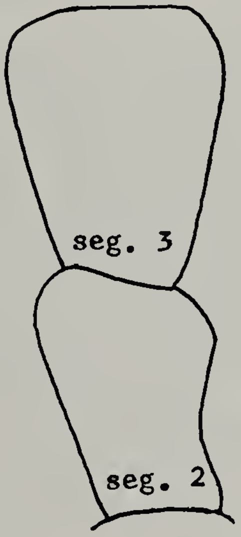

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Fig. 1-5: *Podabrus brevipennis brevipennis* LeC. 1) aedeagus, dorsal view. 2) same, lateral view. 3) same, ventral view. 4) second and third antennal segments. 5) apical margin of last abdominal sternite of female. Fig. 6-7: *Podabrus brevipennis wittmeri* Fend. 6) maculation of front of head of type. 7) second and third antennal segments.

Podabrus brevipennis wittmeri Fender, new subspecies

Elytra entire, about 2½ times as long as their combined widths at humeri. Third antennal segment subconical, a little longer than broad (Fig. 7), intermediate segments with length-width ratio of 14:5. In the type, head flavous in front of eyes, with a dark brown maculation as in Fig. 6.

Female: Unknown.

Holotype male: Wyoming, Medicine Bow Mountains, 11-VII-1936, 9,875 feet [collector unknown]. [Fall collection, Museum of Comparative Zoology].

This specimen was labeled "n. sp." in the Fall collection. Despite its normal elytra, the male genitalia, small eyes, widely separated antennae, thick neck but little narrowed behind the eyes, and a larger indentation of the top of each pronotal elevation, at once show the close association with the parent species.

LeConte and Fall, not having a male before them, could not have known the formula of the claws of the male. They both placed the species in that group in which both sexes have all claws toothed; my group II (1949). Actually it belongs in my group IV, which has claws of male finely cleft on front and middle feet, toothed at base on hind feet, and in the female all claws are broadly toothed at base. This group also contains: *lateralis* LeC., *deceptus* Brown, *obscurevittatus* Fall, *secretus* Brown, *puberulus* LeC., *simplex* LeC., *pattoni* LeC., *gracilis* Fall, *instabilis* Fall, *moestus* Fall, *tetragonoderus* Fall, *altus* Fall, and *pustulatus* Fend.

Mani (1968:54) pointed out the predominance, at high mountain elevations, of insect species with reduced or vestigial wings to complete winglessness. Possibly this species has developed abbreviated elytra at higher elevations, (e.g. above 11,500 feet); whereas populations at lower elevations have retained the entire elytra. More specimens of each, from known elevations, are needed to confirm this.

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ON THE VALIDITY OF *CICINDELA CYANOCEPHALONOTA* ECKHOFF (COLEOPTERA: CICINDELIDAE)

GEORGE C. STEYSKAL

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Agricultural Research Service, USDA
Mail address: c/o U.S. National Museum, Washington, D. C. 20560

Although the name *Cicindela cyanocephalata* Eckhoff, 1939, like numerous other current names, is contrary to certain recommendations in the International Code of Zoological Nomenclature, it conforms to all rules and is therefore a satisfactory replacement name for the preoccupied *C. cyanocephala*. The later name *C. cyanocephalonota* Eckhoff, 1970 (Coleopterists' Bulletin 24: 32) is unnecessary and must be considered a synonym of *C. cyanocephalata*.

NOTES ON *AGRILUS POLITUS POLITUS* SAY AND *AGRILUS POLITUS BURKEI* FISHER (COLEOPTERA: BUPRESTIDAE).

Chris Maser and Frank M. Beer

Puget Sound Museum of Natural History, University of Puget Sound, Tacoma, Washington, 98416, and Department of General Science, Oregon State University, Corvallis, Oregon, 97331, respectively.

Abstract

Agrilus politus politus Say, found on willow, and *A.p. burkei* Fisher, found on alder, are rarely found together and then only when the hosts occur together. Possible hybrids, based on color differences, were found on 2 such occasions in Oregon and California.

On 12 June 1969, specimens of typical *Agrilus politus burkei* Fisher were collected 10 miles west of Junction City, Lane County, Oregon, at an elevation of 450 feet. The habitat was a marshy swale along the side of a small, slowly flowing creek which was bordered by dense brush. The beetles were taken, where they spent the night, from the upper surface of the leaves of young red alder (*Alnus rubra* Bong.). 3 to 5 feet tall. No specimens were found on the under surfaces of the leaves, and none could be found on the trunks. They arrived at the leaves approximately an hour to ½ hour before dark and positioned themselves along the midrib, head upward. No more than 1 individual was observed per leaf.

In the morning they remained in the same place and position as the evening before until the dew, which covered them with a visible layer of moisture, had evaporated. They left the leaves very shortly after they were dry. During the late evening and early morning they could be collected easily by tapping them from the leaves into a killing jar. However, the receptacle had to be directly below, because when the leaves were disturbed, the beetles simply released themselves.

The status of this subspecies has been uncertain, some writers considering it a valid species, though Fisher (1928) described it as a subspecies of *politus*. The form is rather widely distributed along the northwest coast area of the United States and southern Canada, extending southward into northern California. Only rarely are the nominate species and its subspecies found together, and then only when each of their host plants (willow and alder respectively) occur together. On 17-18 June 1960, along Trout Creek, 19 miles southeast of Fields, Harney County, Oregon, *politus* and *burkei* were taken together in good series. Along with them, a brassy, blue-green form occurred, less than one-fourth of the population belonging to this group. Likewise, at Castle Crags, Shasta County, California, both *politus* and *burkei* were taken together along a small stream, and here a single male of the blue-green phase was taken on 21 June 1964. Not much variation in color was observed among the brassy forms collected, nor in fact among the 2 subspecies being discussed. Careful examination of the 3 forms suggests that hybridization is involved. Studies are needed on subspecies crosses, breeding among the presume hybrids, and information on the hybrid's host preference, if any.

LITERATURE CITED

FISHER, W. S. 1928. A revision of the North American species of buprestid beetles belonging to the genus *Agrilus.* U. S. Nat'l. Mus. Bull. 145: 1-347.

BOOK REVIEW

Ice Ages, Their Nature and Effects by Ian Cornwall. 1970. 180 p., 41 text fig., 15 photos. Humanities Press, Inc., 303 Park Ave. South, New York, N. Y. 10010. Cloth, $9.50.

Anyone interested in present distribution patterns of animals and plants must become familiar with the many past geological factors which influence them. The 2 million year period of the Pleistocene, although still poorly known, has played a major role in forming these patterns. The author states it as follows:

> "The ice-ages intruded, with repeated and cumulative climatic stresses, on a world which, for a very long time previously, had enjoyed widespread warm, equable oceanic climates. Their effects on living organisms, both plant and animal, were severe and in the case of many species (and even of larger groups) actually fatal. To many more, though surviving at present in parts of the world which afford them suitable conditions, their former wide distribution has been greatly restricted and dissected by Pleistocene geographical and environmental changes."

There are chapters dealing with physical effects of glaciers, effects of succeeding interglacials, historical outline of the Pleistocene, evidence for climatic sequences, floras and faunas, man in the Ice Age, chronology and dating, and causes of glaciation. There is an excellent glossary, but the bibliography is too brief, missing several major recent publications. The author is lecturer in environmental archaeology at the University of London, and the book naturally stresses European glaciation. It is recommended reading for anyone interested in the fascinating glaciers and zoogeography. We could use such a book with more emphasis on the New World Pleistocene.

(R. E. Woodruff)

or counties listed. Dates are listed by day, month (in Roman numerals), and last 2 digits of the year. Listing of ecological data is encouraged. Location of specimens should be shown in brackets; if the data is extensive these should be abbreviated as shown and the abbreviations listed in the text.

Any article concerning Coleoptera will be considered. Descriptions of new taxa must contain keys (or be correlated with existing keys) and illustrations. All manuscripts should be typed on 8½x11" opaque white paper with 1 inch margins. They should be typed on one side only and double spaced throughout (including title, footnotes, tables, figure legends, and references). All scientific names should be underlined. Use the following order: title, author, author's address, abstract, body of text, references cited, and figures. All footnotes, tables, and figure legends should be provided on separate sheets and double spaced. Indicate approximate figure and table locations in pencil in the margin of the manuscript.

Abstracts should be a concise statement of the facts presented, not *that* they are presented (e.g. list names of organisms, not just that they were discussed or described as new). These abstracts are the key to how your article will be cited in the abstracting journals and should be carefully written.

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NOTICES

Notices to appear on this page are a free service to members and subscribers. Such copy will be limited to the back page, the older notices being moved up and replaced with the newest ones at the bottom. The editor reserves the right to reword such notices for brevity, consistency, and clarity.

CHRYSOMELIDAE: Revising the genus **Leptinotarsa** for North America. Wish to borrow pinned or alcohol material. R. L. Jacques, Dept. of Entomology, Entomology Hall, Purdue University, Lafayette, IN 47907.

SCARABAEIDAE: Interested in obtaining specimens of the genus **Coenonycha** for research and in building up a collection of scarab genera from the U.S.A. Exchange. Mrs. Jean Davidson, Dept. of Entomology, Oregon State University, Corvallis, OR 97331.

BUPRESTIDAE: Will exchange specimens and determine **Chrysobothris** from southwestern U.S.A. Jerry Davidson, Dept. of Entomology, Oregon State University, Corvallis, OR 97331.

STAPHYLINDAE: Currently beginning study of taxonomy and morphology of larvae and adults of the Staphylinid subfamily Leptotyphlinae. Would like to borrow specimens in this group from North America primarily, but would welcome material from Central or South America. J. F. Cornell, Ass't Prof. of Biology. Appalachian State University, Boone, NC 28607.

TENEBRIONIDAE: Will exchange South American, Andean, and desert forms for any other groups of insects from Chile. Luis. D. Pena, G.P.O. Box 2974, Santiago, Chile.

CICINDELIDAE: Interested in obtaining specimens of **Cicindela trifasciata peruviana** from Peru and Ecuador. Will exchange for other Chilean species. Luis E. Pena, G.P.O. Box 2974, Santiago, Chile.

SCARABAEIDAE, CERAMBYCIDAE, LUCANIDAE: Goliath beetles, 14 different aberrations; 200 other species of beetles; for sale. Russell Dunn, Box 468, Sedona, AZ, 86336.

VIET NAM COLLECTION: Will exchange recently collected material from S.E. Asia for material from Southwestern U.S.A. Anyone wishing to determine material from this collection may keep the determined specimens. Bruce W. Miller, Dept. of Biological Sciences, Univ. of Nevada at Las Vegas, Las Vegas, NV 89109.

COLYDIIDAE: Revising the family for America north of Mexico. Wish to borrow material; will exchange for other Coleoptera. Karl H. Stephan, 3038 E. Eastland, Tucson, AZ 85716.

LIMNEBIIDAE: Revising the genus **Ochthebius** for North America. Desire material mounted or in alcohol. F. E. Wood, Dept. Ent., Univ. of Md., College Park, MD 20742.

Compiling check-list: Beetles of Clark Co., Nev. I would like to correspond with Coleopterists who have collected in southern Nevada. B. W. Miller, Dept. of Biol., Univ. of Nev. at Las Vegas, Las Vegas, NV 89109.

SWITZERLAND EXCHANGE: Interested in exchanging the following families: Cerambycidae, Carabidae, Lucanidae, Scarabaeidae (Cetoniinae, Goliothinae, Dynastinae). Ulysse Auberson, 6 les prés du lac, 1400 yverdon VD, Switzerland.

BEETLE MITES: I am engaged in research on Paramegistidae which are phoretic on insects. They are known from Carabidae (**Scarites & Harpalus**), Scarabaeidae, Passalidae (in Australia), millipedes, and ants. Will exchange or purchase these mites in alcohol. W. J. Voss, Texas Tech. College, Dept. of Biology, Lubbock, TX 79409.

SHARP & MUIR: THE COMPARATIVE ANATOMY OF THE MALE GENITAL TUBE IN COLEOPTERA. The classic 1912 monograph and 6 other papers by the same authors, 304 p., 43 pl., bound; $10.00. An essential book for all coleopterists. Entomological Society of America, 4603 Calvert Rd., College Park, MD 20740.

FOR SALE: Casey, T. L. 1910-24. **Memoirs on the Coleoptera** (I-XI); complete set in fair condition, having original covers neatly backed with red tape. Correspondence concerning price solicited, or first reasonable offer. S. D. Hicks, Entomology Research Institute, Room 1004, K. W. Neatby Bldg., Ottawa, Canada.

CICINDELIDAE: The following 3 papers are in preparation: "Cicindelidae of Quebec," "Food of cicindelids of the world," and "**Cicindela ancocisconensis** Harris." Label data, observations, and food habit notes would be appreciated. Andre Larochelle, College Bourget, C. P. 430, Rigaud, Quebec, Canada.

SCARABAEIDAE: Studying myrmecophilous and termitophilous Aphodiinae. Request loan of New World material especially. Will sort from general scarab collections or from light trap samples. Robert E. Woodruff, Fla. Dept. Agr., P. O. Box 1269, Gainesville, FL 32601.

HYDROPHILIDAE: Presently revising the genus **Hydrochus** from North, South, and Central America, including the Antilles. Request loan of any material from the Western Hemisphere. John L. Hellman, Ent. Dept., Univ. Maryland, College Park, MD 20742.

TENEBRIONIDAE: Building world-wide reference collection. Will purchase or exchange other Coleoptera. Especially desire immature stages. Kirby W. Brown, Peabody Museum, Yale Univ., New Haven, CT 06520.

2.705 V25 no.2 Biol.

THE COLEOPTERISTS BULLETIN

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(FOUNDED 1947 BY ROSS H. ARNETT, JR.)

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Manuscripts will be considered from any authors, although those from members of the Coleopterists Society will be given priority. It is suggested that all prospective authors join the Society. All manuscripts should conform to instructions in the **Style Manual for Biological Journals** (2nd Ed.) prepared by the Committee on Form and Style of the Conference of Biological Editors, and published by the American Institute of Biological Sciences, 2000 P Street NW, Washington, D. C. 20063.

The following exceptions are noted: 1) All geographical names are to be spelled out, 2) use words, not symbols, for male and female, 3) use numerals throughout, except to begin a sentence, 4) entomology, -ical, -ist, etc. are to be abbreviated Ent. in literature citations.

Specimen label data should be listed in the following manner: MEXICO: State of Veracruz, Fortin de las Flores, 10-VIII-70, I. B. Jones, under bark of **Pinus moctezumae**, 7000ft. [USNM] (2). The number in parentheses indicates the number of specimens. Geographical names are listed in order with largest units first, with states, departments, provinces, parishes, and/

Continued inside back cover

(Application to mail at second-class postage rates is pending at Gainesville, Florida.)

A NEW SPECIES OF *CINYRA* FROM MEXICO, WITH NOTES ON OTHER SPECIES (BUPRESTIDAE).

G. H. NELSON

Department of Anatomy,
Kansas City College of Osteopathic Medicine,
Kansas City, Missouri 64124.

ABSTRACT

Cinyra parafrontalis n. sp. is described from Yucatan, Mexico, with notes on 3 other Mexican species of *Cinyra*.

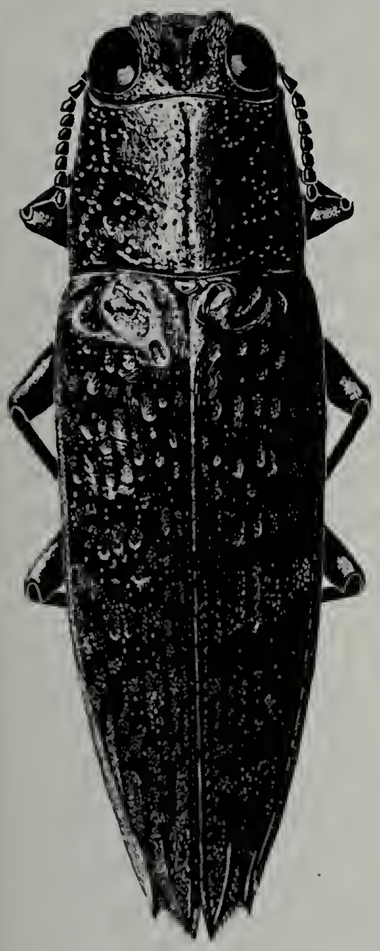
A distinctive new species of *Cinyra* was collected in Pisté, Yucatan, Mexico by Mr. E. C. Welling M. and is described here. New distributional records for other species of *Cinyra* have come to my attention and are included also.

Cinyra parafrontalis NELSON, NEW SPECIES

(Fig. 1,2)

DIAGNOSIS: General form elongate narrow; above cyaneus or purpureoniger with punctate areas distinctly cupreous; below cupreous with tibiae viridiaeneus, tarsi viridicyaneus; antennae with three basal and upper margin of other segments viridicyaneus, lobes of segments 4-11 piceous; elytra with longitudinal, shallow, densely punctured channel near lateral margin.

MALE: *Head* flattened; coarsely, rugosely punctured with irregular,



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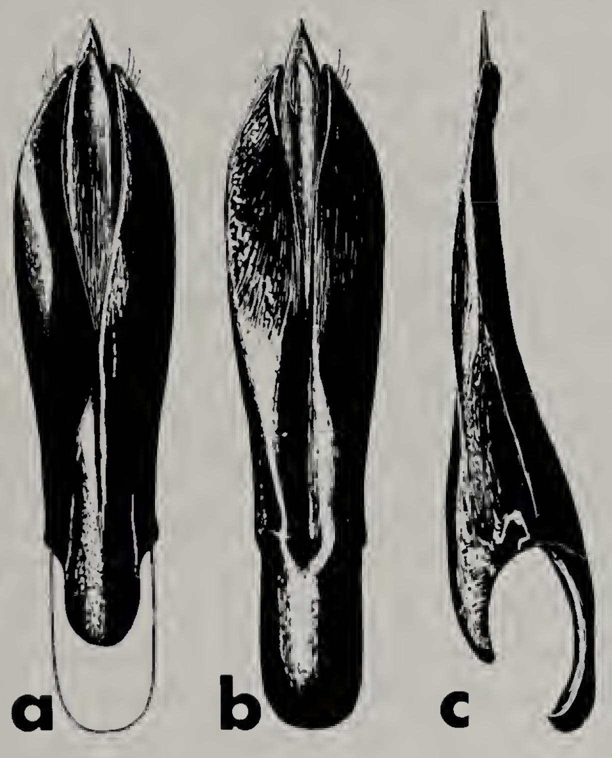

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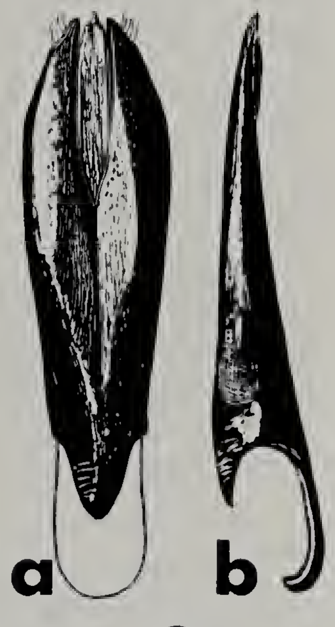

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Fig. 1,2. *Cinyra parafrontalis* Nelson, new species; 1-holotype male; 2-male genitalia, a-dorsal view, b-ventral view, c-lateral view.

Fig. 3. *Cinyra frontalis* Waterhouse, male genitalia, a-dorsal view, b-lateral view.

smooth, raised areas on front and two longitudinal, smooth areas on vertex with groove between, punctured areas moderately clothed with semirecumbent white hair; antennae reaching posterior third of pronotum at sides; third segment more than twice longer than second; serrate from fourth segment; antennae slightly narrowed toward apex.

Pronotum with lateral margins nearly straight but gently converging to narrowest at anterior angles; anterior and posterior margins weakly bisinuate, laterally a punctate groove just behind anterior margin; disk with sparse moderate punctures becoming coarse and more numerous laterally; midline slightly impressed anteriorly and posteriorly, another impression at base toward sides; laterally with smooth margin extending forward to just beyond middle, a densely punctate groove above it clothed with hair.

Elytra slightly wider at base than pronotum; lateral margins subparallel and sinuous to near middle then converging to apices; apex obliquely emarginate with sutural and lateral angles dentiform; disk with striae distinct apically, confused basally; interstrial spaces two, four and six more raised than others; numerous groups of brightly cupreous punctures along striae and densely punctate channel along lateral margin; punctate areas clothed with short, white, semirecumbent hair.

Venter with smooth, raised anterior margin of prosternum bisinuate; prosternum, moderately punctured, transversely depressed medially, swollen laterally; prosternal process slightly convex, almost impunctate, with marginal line impressed at sides, extending less impressed to apex; punctate areas with moderate, semierect, white hair. Meso- and metasterna impressed along midline, surface finely punctate medially, becoming coarse and more numerous laterally; metacoxal plate strongly sinuate along posterior border medially. Abdomen with first segment strongly channelled at midline; surface more densely punctate laterally, with smooth areas along lateral margin; apex of last visible sternite broadly truncate. Pro- and mesotibiae slightly arcuate, metatibia straight; protibia with dense brush on inner side apically; meso- and metatibiae with row of small teeth along inner margin.

Male genitalia (Fig. 2) similar in shape to that of *C. frontalis* Waterhouse (Fig. 3) but slightly longer, median lobe more acute at apex, and base of genitalia swollen dorso-ventrally.

Length: 16.5 mm; width 4.8 mm.

FEMALE: Differs from male in being more robust; antennae shorter, reaching middle of pronotum at sides; last visible abdominal sternite more elongate, narrowly truncate; mesotibiae straight; meso- and metatibiae without row of teeth.

Length 19.0 mm; width 5.75 mm.

Type material: Holotype, male (United States National Museum, No. 71337), and allotype female (writer's collection) from MEXICO, Yucatan, Pisté, IX 1968, E. C. Welling M. Paratypes, all from same locality and collector as holotype: 10 males, 10 females, IX-1968; 7 males, 15 females, VIII-1968; 8 males, 11 females, VII-1968; 5 males, 6 females, VI-1968. Paratypes are deposited in the following collections: California Academy of Sciences, Canadian National Collection, United States National Museum, University of California at Berkeley, W. F. Barr, F. M. Beer, D. S. Verity, G. C. Walters, R. L. Westcott, and the writer.

VARIATION: In color, *Cinyra parafrontalis* varies from bluish-black with bright cupreous punctate areas to black with aeneous punctures. The males vary from 15.0 to 18.5 mm in length and from 4.5 to 5.5 mm in width; the females from 15.0 to 20.0 mm in length and from 4.5 to 6.5 mm in width.

COMPARISONS: This species is similar to *Cinyra frontalis* Waterhouse in general body shape but differs in having: the elytra with larger groups of aeneous or cupreous punctures, a densely punctate shallow channel along lateral margin, antennal segments broader and less parallel, the anterior margin of prosternum raised and smooth and transversely depressed just behind it, the midline concavity of first abdominal segment deeper, and the meso- and metatibiae of the male with a row of teeth on the inner margin. The male genitalia of *C. parafrontalis* differs from *C. frontalis* in having the apex of the median lobe more acute and the base of the genitalia more swollen dorso-ventrally.

NEW DISTRIBUTION RECORDS OF *Cinyra* SPECIES

Cinyra frontalis Waterhouse, 1882, Biologia Centrali-Americana, Insecta, Coleoptera, Buprestidae, 3(1): 15,16. This species was described from Córdoba (Córdova) in Vera Cruz. Specimens have been examined from El Zapotal, 2 miles south of Tuxtla Gutierrez, Chiapas, MEXICO, 9-VII-1957, P. D. Hurd, J. A. Chemsak, and B. J. Rannells.

Cinyra uniformis Waterhouse, 1889, Biologia Centrali-Americana, Insecta, Coleoptera, Buprestidae supplement, 3(1): 174. Höge collected the type from Atlixco in Puebla. New records from Mexico include the following: 10 miles northeast of Juchitan, Oaxaca, 18-VII-1952, E. E. Gilbert and C. D. MacNeil; 11 miles east of Apatzingan, Michoacan, 20-VIII-1954, E. G. Linsley, J. W. MacSwain, and R. F. Smith.

Cinyra sexspinosa Waterhouse, 1889, Biologia Centrali-Americana, Insecta, Coleoptera, Buprestidae supplement, 3(1): 175. This species was described from Acapulco in Guerrero, Mexico. New records extend the known range considerably and include the following: 3 miles west of Tehuantepec, Oaxaca, 9-VII-to 2-VIII-1965, on *Mimosa nelsonii* Robins, G. H. Nelson; 14 kilometers west of Texquisistlan, Oaxaca, 19-VII-1963, Eric Fisher; Jalapa del Marquez, Oaxaca, 28-VII-1962, A. Michelbacher; 2.5 miles north of Mazatlan, Sinaloa, 22-VII-1965, D. S. Verity; 15 miles E. Navajoa, Sonora, 23 to 30-VII-1965, D. S. Verity; same locality, 14-21-VII-1958, 28-VIII-1959, 30-VIII-1960, 17-VIII-1963, all by R. L. Westcott who states that he collected them on a species of *Robinia*. The specimens from the states of Sinaloa and Sonora exhibit a bluish color while those from Oaxaca tend to be more cupreous.

ACKNOWLEDGEMENTS

I want to thank Dr. Henry Hespenheide for comparing specimens with types in the British Museum of Natural History, Mr. A. Descarpentries for the loan of types in the Muséum National D'Histoire Naturelle, and to the following individuals for the loan of material: Dr. John Chemsak of the University of California at Berkeley, Mr. David Verity, and Mr. Rick Westcott.

NOMENCLATORIAL NOTES

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This section will abstract opinions appearing in the Bulletin of Zoological Nomenclature (BZN) which affect the nomenclature of the Coleoptera. The original texts in the BZN should be consulted for full information. BZN Vol. 25, 1968 is adopted as the point of departure.

Opinion 848. *Xyleborus* Eichhoff 1864 (gender masculine: family SCOLYTIDAE; type-species *Bostrichus monographus* Fabricius) is placed on the Official List of Generic Names and its type species placed on the Official List of Specific Names. *Xyleborus* Bowditch 1825 is placed on the Official Index of Rejected and Invalid Names. (BZN vol. 25, 1968, pp. 18-19.)

Opinion 862. *Galerita* Fabricius 1801 (gender feminine; family CARABIDAE; type species *Carabus americanus* Linnaeus) is placed on the Official List of Generic Names and its type-species placed on the Official List of Specific Names. *Galerita* Gouan 1770 is placed on the Official Index of Rejected and Invalid Names. (BZN vol. 25, 1968, pp. 98-99.)

Opinion 876. *Proteinus* Latreille 1796 (gender masculine; family STAPHYLINIDAE; type-species *Dermestes brachypterus* Fabricius) and *Brachypterolus* Grouvelle 1913 (gender masculine; family Staphylinidae; type-species *Dermestes pulicarius* Linnaeus) are placed on the Official List of Generic Names and their type-species are placed on the Official List of Specific Names. (BZN vol. 26, 1969, pp. 14-15.)

Opinion 887. *Bryaxis* Kugelann 1794 (gender masculine; family PSELAPHIDAE; type-species *Pselaphus bulbifer* Reichenbach 1816) and *Bythinus* Leach 1817 (gender masculine; family Pselaphidae; type-species *Pselaphus securiger* Reichenbach) are placed on the Official List of Generic Names and their type-species are placed on the Official List of Specific Names. *Bryaxis* Leach 1817, *Arcopagus* Leach 1817, and *Bolbobythus* Raffray 1904 are placed on the Official List of Rejected and Invalid Generic Names. (BZN vol. 26, 1969, pp. 133-135.)

Opinion 908. *Crioceris* Muller 1764 (gender masculine; family CHRYSOMELIDAE; type-species *Chrysomela asparagi* Linnaeus 1758), *Lema* Fabricius 1798 (gender feminine; family Chrysomelidae; type-species *Lema Cyanea* Fabricius 1798), and *Lilioceris Reitter* 1912 (gender masculine; family Chrysomelidae; type-species *Attelabus lilii* Scopoli 1763) are placed on the Official List of Generic Names and their type-species are placed on the Official List of Specific Names. (BZN vol. 27, 1970, pp. 12-13.)

Opinion 928. *Pachyrhynchus* Germar 1824 (gender masculine; family CURCULIONIDAE; type-species *Pachyrhynchus moniliferus* Germar 1824) is placed on the Official List of Generic Names and its type-species is placed on the Official List of Specific Names. *Pachyrhynchus* Wagler is placed on the Official List of Rejected and Invalid Names. (BZN vol. 27, 1970, pp. 93-94.)

DIEL PERIODICITIES OF CERTAIN CARRION BEETLES (COLEOPTERA: SILPHIDAE)

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Abstract

A study to determine the diel periodicities of certain carrion beetles was conducted at 2 locations in New Jersey. Beetles were attracted to decomposing chicken leg bait in concealed cans suspended above the ground. This design required olfaction for bait location. Data from 19 diurnal collections and 18 nocturnal collections were recorded. *Silpha americana*, *S. noveboracensis*, *S. inaequalis*, and *Nicrophorus tomentosus* were either primarily or completely diurnal in finding carrion. *Necrodes surinamensis* and *Nicrophorus orbicollis* were all taken nocturnally. Leptodiridae, Staphylinidae, and Histeridae that were attracted to this carrion were primarily diurnal.

Introduction

A number of observations have been published on the nocturnal and diurnal activities of carrion beetles. These indicate that certain species are nocturnal or diurnal, or both. When referring to the Nicrophori, Milne and Milne (1944) wrote, "Difficulty was reported in observing the burying behavior because of its nocturnal nature . . ." Although they stated that " . . . the burying activities had been watched repeatedly in daylight at Irondale (Canada) . . ." They commented further about " . . . the preference shown by *Nicrophorus* for work in the shade or at twilight or night . . ."

Abbott (1927), in discussing his work with *Nicrophorus tomentosus* and *N. orbicollis*, stated, "The very fact that the beetles are nocturnal, and work in almost absolute darkness, sufficiently demonstrates the importance of the olfactory sense."

These and other similar observations had been noted, but I was struck by the complete absence of any quantitative data on diel periodicity of carrion beetles. During portions of the summers of 1969 and 1970 I made an effort to collect such data. The projects were set up in Hutcheson Memorial Forest, near East Millstone, Somerset County, New Jersey, and Stokes State Forest, Sussex County, New Jersey.

The 24 hour diel period is usually divided into the crepuscular period (twilight), the diurnal period (daylight), and the nocturnal period (darkness). In this study I distinguished only diurnal and nocturnal activity. No attempt was made to delimit a crepuscular period nor to capture beetles during this period.

In addition to recording capture data on all species of Silphidae, data also were recorded on individuals of the families Leptodiridae, Histeridae, and Staphylinidae. A previous study showed that these 4 families are very important members of the carrion community in New Jersey (Shubeck 1969).

Acknowledgments: I would like to thank the Hutcheson Memorial Forest Committee of Rutgers University for encouraging my research on Silphidae in Hutcheson Memorial Forest.

METHODS

A pilot study was conducted at the New Jersey State School of Conservation at Stokes State Forest from 11 to 14 June 1969. Two of my students, Celeste Lupi and Bonnie Stroger, carried out the collecting duties as part of an assigned ecology project. A one-gallon air can (Shubeck 1968a), suspended 1.5 meters above the ground, was baited with a fresh chicken leg and periodically checked for 3 days. The diurnal collection included beetles attracted between 7:30 AM and 7:30 PM and collected at 7:30 PM; the nocturnal collection included beetles apparently attracted since 7:30 PM and collected at 7:30 AM the following morning.

In June 1970, a more elaborate trapping arrangement was devised. Each one-gallon can was inserted up into a box having a 1/2 inch wire mesh at the top. Two inches above this mesh opening was a flat cover which kept out rain but allowed ingress of insects. This entire unit, attached to a stake, was situated so the opening was 3/4 meter above the ground. Four such traps, each baited with a fresh chicken leg, were set up in a single line about 3 meters apart. This experiment, also at Stokes State Forest, ran from 3 June, when the traps were baited, to 12 June. Collections began on the second day after baiting and continued until the morning of the ninth day. In order to exclude crepuscular data, the traps were closed after 7:45 PM and opened again at 9:00 PM when it was completely dark. The nocturnal collection was then taken at 7:00 AM the following morning and the traps were left undisturbed during the rest of the day. After being collected, identified, and recorded, all beetles were released about 10 meters from the traps.

Later in the month these box traps were set up in Hutcheson Memorial Forest, where previous collecting had shown that silphids could be taken in much larger numbers than in Stokes State Forest. The 4 traps were set up so that there was a north, east, south, and west trap, each 5 meters distant from a central stake. They were baited on 19 June, and collections were made daily from the fourth to the eighth day. Diurnal collections included beetles attracted from 7:00 AM to 7:30 PM, and nocturnal collections included beetles attracted from 8:30 PM to 7:00 AM. After being collected, identified, and recorded, all beetles were released about 40 meters from the traps.

The traps were left in the forest, and later in the summer (7 August) they were baited again. Collections were made from the third to the eighth day. Since the period of daylight was getting shorter, diurnal collections were made at 7:00 PM, the traps were covered, and then opened at 8:10 PM for the nocturnal catch. The nocturnal collections were made at 7:00 AM. As in June, beetles were released about 40 meters from the traps.

RESULTS AND DISCUSSION

The total number of silphids collected during the pilot study in 1969 was disappointingly small (Table 1). The results suggested that *Nicrophorus orbicollis* was nocturnal and that members of the genus *Silpha* might be diurnal. These meager, but interesting, results served as the stimulus for work the following summer.

TABLE 1. Carrion beetles collected at Stokes State Forest between 11 and 14 June 1969. Day number above each column applies to the number of days after bait was set.

Diurnal Data (7:30 AM to 7:30 PM)
(Collections at 7:30 PM)

Day	1	2	3	Total
Silpha americana	1	1	–	2
S. noveboracensis	–	1	–	1
Nicrophorus orbicollis	–	–	–	0
Histeridae	–	1	1	2

Nocturnal Data (7:30 PM to 7:30 AM)
(Collections at 7:30 AM)

	2	3	Total
Silpha americana	–	–	0
S. noveboracensis	–	–	0
Nicrophorus orbicollis	6	3	9
Histeridae	–	–	0

In the 1970 study at Stokes, the use of more traps and the greater number of collecting days increased the total number of beetles taken (Table 2). *Silpha americana* and *S. noveboracensis* seemed to be primarily diurnal (only 1 of the latter was taken nocturnally). Only 2 *Nicrophorus orbicollis* were taken, but as in the previous year, they were taken nocturnally only. The results concerning Staphylinidae and Histeridae were most interesting. Of 76 staphylinids taken, 74 were diurnal, and 209 of 211 histerids were diurnal.

TABLE 2. Carrion beetles collected at Stokes State Forest between 3 and 12 June 1970. Day number above each column applies to the number of days after bait was set.

Diurnal Data (7 AM to 7:45 PM)
(Collections at 7:45 PM)

Day	2	3	4	5	6	7	8	Total
Silpha americana	–	–	1	–	2	–	2	5
S. noveboracensis	–	–	–	3	7	5	6	21
Nicrophorus orbicollis	–	–	–	–	–	–	–	0
Staphylinidae	–	–	–	16	17	19	22	74
Histeridae	–	–	–	52	81	37	39	209

Nocturnal Data (9 PM to 7 AM)
(Collections at 7 AM)

	3	4	5	6	7	8	9	Total
Silpha americana	–	–	–	–	–	–	–	0
S. noveboracensis	–	–	–	–	1	–	–	1
Nicrophorus orbicollis	1	–	–	1	–	–	–	2
Staphylinidae	–	–	–	1	–	–	1	2
Histeridae	–	–	–	–	2	–	–	2

The data in Table 3, from Hutcheson Memorial Forest in late June, were especially important because of the large numbers of insects taken. There seems to be no question that *Silpha noveboracensis* is diurnal; 1713 of 1720 individuals were taken diurnally. Much smaller numbers of *Silpha americana* and *Silpha inaequalis* were taken, and they were exclusively diurnal. *Nicrophorus orbicollis* was taken in very small numbers, but it was exclusively nocturnal as in the case of the 2 previously mentioned experiments. *Nicrophorus tomentosus* was taken for the first time, and interestingly all 9 individuals were diurnal. The other species of this genus was never taken diurnally. Once again, the staphylinids and histerids were taken in the diurnal collections in overwhelming numbers. Small numbers of Leptodiridae were taken for the first time, and they were also diurnal.

TABLE 3. CARRION BEETLES COLLECTED AT HUTCHESON MEMORIAL FOREST BETWEEN 19 AND 28 JUNE 1970. DAY NUMBER ABOVE EACH COLUMN APPLIES TO THE NUMBER OF DAYS AFTER BAIT WAS SET.

Diurnal Data (7 AM to 7:30 PM)
(Collections at 7:30 PM)

Day	4	5	6	7	Total
Silpha americana	5	–	1	–	6
S. noveboracensis	492	528	665	28	1713
S. inaequalis	9	9	6	–	24
Nicrophorus orbicollis	–	–	–	–	0
N. tomentosus	2	3	3	1	9
Leptodiridae	2	–	1	1	4
Staphylinidae	3	20	10	4	37
Histeridae	5	1	7	–	13

Nocturnal Data (8:30 PM to 7 AM)
(Collections at 7 AM)

	5	6	7	8	Total
Silpha americana	–	–	–	–	0
S. noveboracensis	2	1	–	4	7
S. inaequalis	–	–	–	–	0
Nicrophorus orbicollis	2	–	1	–	3
N. tomentosus	–	–	–	–	0
Leptodiridae	–	–	–	–	0
Staphylinidae	–	2	1	–	3
Histeridae	–	–	–	–	0

Table 4 shows the results of the final experiment which was run in August. These results provided further evidence that *Silpha americana* and *Nicrophorus tomentosus* were diurnal, and that *N. orbicollis* was nocturnal. Further evidence of the diurnal activity of the families Leptodiridae, Staphylinidae, and Histeridae also was present. One new silphid species was taken. Unfortunately only 3 *Necrodes surinamensis* were captured, but each was taken in separate nocturnal collections.

TABLE 4. CARRION BEETLES COLLECTED AT HUTCHESON MEMORIAL FOREST BETWEEN 7 AND 15 AUGUST 1970. DAY NUMBER ABOVE EACH COLUMN APPLIES TO THE NUMBER OF DAYS AFTER BAIT WAS SET.

Diurnal Data (7 AM to 7 PM)
(Collections at 7 PM)

Day	3	4	5	6	7	Total
Silpha americana	–	1	3	9	4	17
Nicrophorus orbicollis	–	–	–	–	–	0
N. tomentosus	2	3	2	2	2	11
Necrodes surinamensis	–	–	–	–	–	0
Leptodiridae	–	1	2	2	–	5
Staphylinidae	16	20	17	10	18	81
Histeridae	–	2	2	11	5	20

Nocturnal Data (8:10 PM to 7 AM)
(Collections at 7 AM)

	4	5	6	7	8	Total
Silpha americana	–	–	1	–	–	1
Nicrophorus orbicollis	15	6	3	2	1	27
N. tomentosus	1	–	–	–	–	1
Necrodes surinamensis	–	1	1	–	1	3
Leptodiridae	–	–	–	–	–	0
Staphylinidae	3	–	2	1	–	6
Histeridae	–	–	–	–	–	0

The data from the 4 experiments were totaled and tabulated under diurnal and nocturnal columns in Table 5. All 41 *Nicrophorus orbicollis* taken during the 4 trial periods were nocturnal, and 20 of 21 *N. tomentosus* were diurnal. *Silpha inaequalis* was exclusively diurnal, and 30 of 31 *S. americana* were diurnal. Over 99% of the 1743 *S. noveboracensis* were active diurnally. Although no firm conclusion can be based on the 3 *Necrodes surinamensis* taken, the data suggest that this species is nocturnal. The data for leptodirids, staphylinids, and histerids found on carrion with Silphidae in Hutcheson Memorial Forest and Stokes State Forest indicate clearly that they are active during the day. In a study of Coleoptera associated with pig carrion in South Carolina, Payne and King (1969) found the Staphylinidae active both day and night. They also found that the Histeridae hid beneath the pig carcasses during the day and became active at night. I cannot explain these differences between the diel periodicities of rove and hister beetles in New Jersey as compared with South Carolina.

TABLE 5. TOTAL NUMBERS OF CARRION BEETLES COLLECTED AT HUTCHESON MEMORIAL FOREST AND STOKES STATE FOREST DURING THE SUMMERS OF 1969 AND 1970.

	Diurnal	Nocturnal
Silpha americana	30	1
S. noveboracensis	1735	8
S. inaequalis	24	0
Necrodes surinamensis	0	3
Nicrophorus orbicollis	0	41
N. tomentosus	20	1
Leptodiridae	9	0
Staphylinidae	192	11
Histeridae	244	2

On the other hand, there was a great similarity between my results with silphids in New Jersey and those obtained by Ratcliffe and Luedtke (1969) in Nebraska. The Nebraska study compared the species of Silphidae taken on exposed carrion versus those taken on carrion covered by bark. If the *covered* carrion can be thought of as an artificial nocturnal carrion microhabitat, this can explain why 2 species common to both studies (*Nicrophorus orbicollis* and *Necrodes surinamensis*) manifested similar nocturnal results. Also, if it can be assumed that diurnal beetles are active during the day but hide in the leaf litter during the night, this can explain why 2 silphids captured on the exposed carcass in Nebraska (*Silpha inaequalis* and *S. noveboracensis*) manifested results similar to the diurnal captures in New Jersey. In addition, Ratcliffe and Luedtke captured 2 other *Silpha* species almost exclusively on exposed carrion and *S. americana* was almost exclusively diurnal in New Jersey. This raises the possibility that *Silpha* may be diurnal, whereas in the New Jersey study, 1 *Nicrophorus* species is apparently diurnal and a second is nocturnal.

In addition to the diurnal-nocturnal information gained in this study, 2 other observations can be made. First, even diurnal carrion beetles apparently use their sense of olfaction to locate carrion; the bait (chicken legs) was placed in the bottom of cans completely concealed within wooden boxes suspended above ground. Although evidence has been published that random movement is involved (Shubeck 1968b), it is now clear that the final clueing in on carrion can be based on olfaction alone. This apparently applies also to carrion beetles of the families Staphylinidae, Histeridae, and Leptodiridae.

A second interesting point is that the diurnal *Nicrophorus tomentosus* bears a striking resemblance to a bumblebee, even to its buzz. Milne and Milne (1944) stated that, "The resemblance to *Bombus* [spp.] is enhanced by the golden body hair, the yellow inner surfaces of the elytra (which are held back to back over the midline) and the creamy cast to the flying wings." If most species of *Nicrophorus* are eventually found to be nocturnal, it is possible that *N. tomentosus* evolved away from the nocturnal behavior pattern of the genus through the mechanism of mimicry. If, on the other hand, *Silpha* is more primitive than *Nicrophorus,* as Arnett (1944) believes, then it can be conjectured that *Nicrophorus* (other than *N. tomentosus*) evolved away from the diurnal niche and into the nocturnal one. *N. tomentosus* might then be assumed to be the most primitive species of the genus and the species most closely related to *Silpha.*

I am planning an experimental study on the possible mimicry of the bumblebee by *N. tomentosus.* The major problem will undoubtedly be obtaining an adequate supply of specimens since I have never collected this species in large numbers.

CONCLUSIONS

Six species of Silphidae were captured on carrion on 22 collecting days during the summers of 1969 and 1970 in New Jersey. One species was exclusively diurnal and 2 others were exclusively nocturnal (Table 5). The 3 others were primarily diurnal. *Nicrophorus orbicollis* and *Necrodes surinamensis* were active during the nocturnal hours, while *N. tomentosus, Silpha inaequalis, S. noveboracensis,* and *S. americana* were active during the diurnal hours. Virtually all Leptodiridae, Staphylinidae, and Histeridae captured on carrion were diurnal. Furthermore, the carrion-inhabiting members of these 3 families are apparently capable of locating carrion through olfaction, as are the silphids, since the carrion was completely concealed and above the ground.

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BOOK REVIEW

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Revisión monográfica de los Canthonina americanos, parts I, II, and III. Gonzalo Halffter and Antonio Martinez, Revista de la Sociedad Mexicana de Historia Natural 27:89-177, 28:79-116, 29:209-290, illus. (1966, 1967, 968).

The canthonines are a group of ball-rolling dung beetles found primarily in the southern continents and islands of the world, being most richly represented in South America. The only existing revision of the American (that is, New World) species was that of Edgar von Harold (1868), on *Canthon sensu lato,* until about 30 years ago. At that time, Renaud Paulian reviewed the group, concentrating on those species in the genus *Deltochilum,* and Vladimir Balthasar keyed most of the remaining species, which he placed in *Canthon,* ignoring several previous attempts to divide that genus. About 20 years ago, a group of Latin American workers, Francisco Pereira, Antonio Martinez, and Gonzalo Halffter, first turned their attention to the American canthonines, beginning the process of specific and generic description and re-evaluation of supra-specific categories which is continuing to the present day. In view of the very large size and diversity of the group, and the location of many types in Europe, this process has been a particularly difficult one and the results up to now have been quite unsatisfactory for those workers such as the present reviewer who have had to deal with some small sections of the group. This dissatisfaction has stemmed not from the quality of the work produced, which generally has been high, but from the piece-meal approach which the Latin American workers have had to adopt. This approach has been to attack the great mass of species from around the edges, detaching first those elements which appeared most divergent and leaving a heterogeneous and nebulous centre. While each detached portion has generally been clearly defined as a separate genus, the status of this genus could never be objectively evaluated since it could not be compared with the vague central mass or the other quite unrelated detached portions.

Lost in the centre has been the genus *Canthon* itself, by far the largest of the group and the one collectors were most likely to encounter. It is true that a very thorough revision and morphological analysis of the North American *Canthon* were produced by Halffter in 1961, but this still left the bulk of the species untouched, and any worker wishing to identify a South American *Canthon* had to (and still has to) turn to Harold and Balthasar.

The general confusion was compounded by the large number of short, somewhat incoherent papers which the workers in question continued to produce over the years, often in obscure journals. It is true that in 1956 Pereira and Martinez attempted to review and define most of the American canthonine genera, but their effort did little to clarify the situation, as the state of knowledge of the group at that time was such that it was impossible to define any generic limits convincingly. Genera were grouped in a totally artificial manner and not adequately compared with other genera. Some genera appeared to be of much lower rank than others. The outside observer could not judge from the evidence given whether any genus was valid or not, either as a genus *per se* or even as a natural grouping of any sort. His instinctive reaction was to reject the new generic categories out of hand.

Into this welter of confusion the two most competent workers in the group, Gonzalo Halffter and Antonio Martinez, have now boldly stepped. Although only the first three parts of their work have appeared, the time is opportune to call attention to the existence of this very important effort. The professed aim of the authors is to adopt uniform criteria for the first time in reconsidering all the American Canthonina. A secondary aim is, finally, to mount a determined assault on the genus *Canthon* itself.

They begin with a brief consideration of the status of the tribe Scarabaeini and the sub-tribe Canthonina, for which they provide a diagnosis which will be useful to workers in other parts of the world. They point out that while it is not incorrect to elevate the canthonines (and all other subtribes) to tribal level, this process when carried to its logical conclusion would elevate the family Scarabaeidae to a superfamily and throw the classification of the Coleoptera off balance. What is incorrect is arbitrarily raising some equivalent categories to higher rank and not others, as Paulian has done in the "Traité." They accept the Eurysternini as a separate tribe, but they do not adequately distinguish it from the Scarabaeini. Except for the elevation of the Eurysternini, the higher classification adopted is that proposed by André Janssens in 1949 and now generally accepted. They trace this classification back to L. A. Péringuey in 1900, but this reviewer would consider its beginnings to have been established by G. van Lansberge in 1874.

The genera are treated one by one, and for each a diagnosis is given, its affinities discussed, the type species named, the included species and their distributions listed, and keys presented to the subgenera, species groups, species, and subspecies. Line drawings, maps and photographs are used, including some microphotographs of mouthparts and genitalic characters. Some genera previously proposed, such as *Peltecanthon,* are adequately described for the first time, other genera are lowered to subgenus rank, one genus (*Agamopus*) is brought in from the tribe Coprini, several new species are described, and previously unknown morphological details are revealed, of which perhaps the most interesting are the small teeth present on the galea of *Sinapisoma,* the only known scarabaeine with a non-membranous distagalea. The very unusual genitalic capsule of *Ipselissus* is described for the first time, and a very interesting analysis is presented of the similarities between four genera around *Ipselissus,* which together have a distribution as follows: Brazil and adjacent areas, the Greater Antilles, South-western Australia, and Mauritius. Unfortunately so much emphasis is placed on the similarities between these genera that their differences are obscured, and it is not altogether clear from the discussion why the South American *Ipselissus* and the Antillean *Canthonella* are maintained as separate genera. Some genera such as *Scybalophagus* are treated in more detail because of inadequate previous coverage, and new distributional and biological data are presented for these.

Nearly all the categories proposed by previous workers are maintained as natural groups, although a few are lowered to subgeneric rank. In some instances this action appears questionable, but until all the parts of the monograph have appeared it is not possible to come to a decision about this, for it is important to emphasize that we are not out of the woods yet. The authors state that they are leaving the final analysis of the genera and their phylogenetic arrangement to the last, and there will not even be any key to the genera until then. The non-specialist is still not always able to identify a specimen to genus and is still faced with pretty much the same problems as before, being encouraged only by the prospect that at the end he will finally be able to put the pieces of the puzzle together. As the authors themselves point out, the order of presentation of the genera in the present series is artificial and even illogical, with fairly typical canthonine genera such as those around *Megathopa* sandwiched between highly aberrant forms such as *Eudinopus* and *Streblopus*, and other genera quite artificially associated following the original arrangement of Pereira and Martinez.

The standard of work is very high and great care has been taken in the preparation of the descriptions and keys. In the first three parts, the authors have got as far as the first subgenus of the genus *Canthon.* Thirteen genera have been treated, something over one third of the total, but the two largest, *Canthon sensu stricto* and *Deltochilum*, remain to be considered.

The same characters, about 55 in number, are investigated in each genus. This not only enables uniform criteria to be adopted in the group for the first time, but it also permits numerical analysis of the classification, something which the authors have promised to present in the last part, together with a more traditional phylogenetic analysis and a key to the genera.

Dr. Halffter spent several months in the Paris Museum studying the very large collection there inherited from Edgar von Harold, A. Boucomont, and other dung beetle specialists, and both authors have had very extensive field experience in South and Central America and Mexico.

When this work is completed, we will at long last have a clear picture of the classification of the American Canthonina and a usable system which will permit the identification of any species. In eager anticipation of this triumphant moment we can now only encourage Drs. Halffter and and Martinez to continue, with all deliberate speed, the excellent work that they have begun.

BOOK REVIEWS

The following 2 articles are extremely important to taxonomists wishing to locate type specimens. The International Commission on Zoological Nomenclature has recommended that all type repositories have the obligation of publishing their type holdings (recommendation 72D4). We would appreciate knowing of other published type holdings which we will then list in future issues of the *Coleopterists Bulletin.*

A Catalogue of Types of Coleoptera in the Canadian National Collection of Insects by Raymond de Ruette, 1970. Mem. Ent. Soc. Canada 72:1-134.

This list includes all type specimens catalogued through 31 Dec. 1968. There are 679 holotypes, 355 allotypes, 47 lectotypes, 2 neotypes; 211 species are represented by syntypes and 1392 species by paratypes or paralectotypes. The families are arranged alphabetically and there is an index to all species names.

All species are cited alphabetically under the original combination, and reference is made to the original description. All label data are listed for holotypes, neotypes, lectotypes, and syntypes. For paratypes and paralectotypes the number of specimens is listed with the state or provincial records listed for Canada, U.S., and Mexico, but only by country for others. All name changes known to the author are listed after each entry.

The Canadian National Collection is recognized world wide as one of the major collections and type repositories. The Coleoptera portion has grown from a 1960 estimate of 550,000 specimens in 1150 USNM drawers to the present estimate of 1,200,000 specimens in 3500 USNM drawers.

Catalogue of the types in the Snow Entomological Museum. Part VI (Coleoptera) by G. W. Byers and J. B. Karren. 1968. Univ. Kansas Sci. Bull. 48(1):1-20.

This list contains information on the types of 544 species and subspecies as of 1967. Citations of original descriptions are given only for holotypes, allotypes, syntypes, lectotypes, or neotypes, although paratypes are listed under each species. No synonymy or reassignments are listed; only the original combination is mentioned. Type localities are not listed. (R. E. Woodruff)

LITERATURE NOTICES

In this section we will note recent revisions, monographs, or general Coleoptera references which are brought to our attention, and which space permits. Authors are invited to send copies of any such papers for inclusion here.

Moldenke, Andrew R. 1970. A revision of the Clytrinae of North America north of the Isthmus of Panama (Coleoptera: Chrysomelidae). Stanford Univ., Standford, California. 310 p.; 261 fig.; 44 maps. Paper $5.00.

Reyes C., Pedro. 1970. Coleoptera, Passalidae: Morfologia y division en Grandes grupos; generos Americanos. Folia Entomologica Mexicana No. 20-22. In Spanish (English summary p. 217-223). 240 p.; 86 fig.; 3 photos. Paper $6.00.

Kirk, Vernon M. 1969-70. A list of the beetles of South Carolina. Part 1—Northern Coastal plain. South Carolina Agr. Exp. Sta. Tech. Bull. 1033 (Dec., 1969):1-124.
Part 2—Mountain, piedmont and southern coastal plain. South Carolina Agr. Exp. Sta. Tech. Bull. 1038 (Aug., 1970):1-117.

Barron, J. R. 1971. A revision of the Trogositidae of America north of Mexico (Coleoptera: Cleroidea). Mem. Ent. Soc. Canada 75:1-143; 165 fig.

Johnson, Clarence D. 1970. Biosystematics of the Arizona, California, and Oregon species of the seed beetle genus *Acanthoscelides* Schilsky (Coleoptera: Bruchidae). Univ. California Publ. Ent. 59:1-116; 35 fig. Paper $5.50.

A NEW GENUS AND SPECIES OF ROVE BEETLE FROM CALIFORNIA (COLEOPTERA: STAPHYLINIDAE)

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ABSTRACT

A new genus and species (*Xenicopoda helenae*) of the subfamily Omaliinae and tribe Anthophagini, is described from a unique specimen from Mt. Wilson, California.

Xenicopoda Moore & Legner, NEW GENUS

Type species: *Xenicopoda helenae* Moore & Legner, NEW SPECIES

Head as wide as long, somewhat produced in front; clypeo-labral suture impressed; eyes prominent; tempora not as prominent as eyes, half as long as eyes, rounded to a broad neck; nuchal constriction present but not deeply impressed; frontal calluses diffuse; anterior tentorial pits deep. Antennae filiform, all segments longer than wide, first 4 segments glabrous except for a few scattered setae. Labrum almost as long as wide, outer apical angles broadly rounded, apex very shallowly emarginate. Maxillary palpi 4-segmented; first segment small, second and third about equal in size and shape, fourth about as long as wide and about one-half longer than third, gradually narrowed to the bluntly pointed apex. Labial palpi 3-segmented; first segment slightly longer than wide, cylindrical; second narrower and slightly shorter than first, cylindrical; third narrower and longer than second, almost twice as long as wide, cylindrical. Mentum trapezoidal. Gular sutures distinctly separate, most approximate in the middle, widely divergent before and behind.

Pronotum subquadrate, as wide as long, sides entire, margins reflexed in basal half; with a small, very faint impression centrally in basal fourth. Elytra covering first abdominal segment. Prosternum short, its process obtusely pointed, extending a short distance between the coxae. Mesosternum not longitudinally carinate, its process pointed, extending about a third of the distance between the coxae. Metasternal process pointed, extending about a third of the distance between the coxae, not meeting the mesosternal process.

Femora moderately stout, not arcuate. Anterior tibiae stout, with a few scattered prominent spines on the outer face anteriorly. Anterior tarsi broad; first 4 segments bilobed, densely pubescent beneath; first segment almost as long as next 3 together; fifth segment strongly arcuate, longer than the first 4 together. Inner anterior unguis strongly arcuate, very large, almost as long as the tarsi, more than twice as wide and twice

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[1] Research Associate and Assistant Professor of Biological Control, respectively.

[2] Coleopt. Bull. 20:47-56.

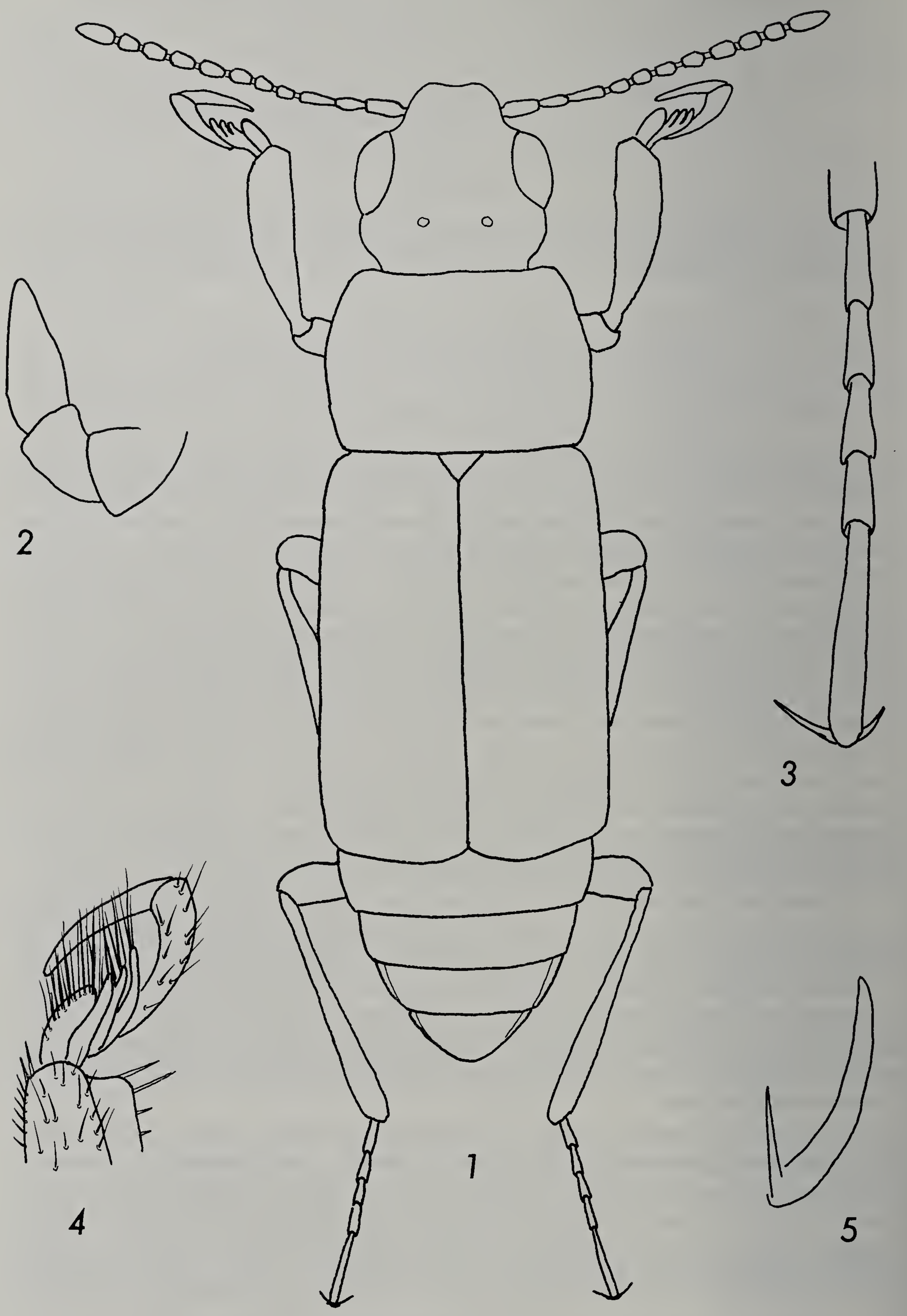

Fig. 1-5: *Xenicopoda helenae* n. sp. 1. Dorsal view. 2. Apical segments of maxillary palpus. 3. Posterior tarsus. 4. Anterior tarsus. 5. Anterior unguis.

as long as outer unguis. Middle and posterior tibiae slender, without spines on the outer edge, pubescent. Posterior tarsi two-thirds as long as tibiae; 5-segmented, first 4 segments subequal, last segment almost as long as preceding 3 together.

First 3 visible abdominal segments without paratergites, next 2 segments with very narrow traces of paratergites.

This genus belongs in the tribe Anthophagini of the subfamily Omaliinae. In Moore's 1966 key to the genera of the Nearctic Anthophagini[2] it will go to couplet 20 where it may be separated by the very large inner anterior ungues. It is readily distinguished from all members of that tribe, and probably from all other Omaliinae, by the unmargined abdominal segments, the structure of the anterior tarsi and the asymmetrical anterior ungues.

The single species described below superficially resembles some members of the genus *Eusphalerum* (tribe Eusphalerini) from which it differs in the structure of the posterior tarsi, the presence of a nuchal constriction, the spinous anterior tibiae and the characters mentioned above.

Xenicopoda helenae Moore & Legner, NEW SPECIES

Color largely rufo-testaceous except head and abdomen which are piceorufous with sides of abdomen paler, and disc of pronotum and abdomen infumate. Head as wide as long, broadly shallowly impressed in front around tentorial pits with small slight tumidity between pits; microreticulate throughout, area behind nuchal constriction transversely strigulo-reticulate; very finely and sparsely punctured throughout, beneath micro-reticulate and sparsely finely punctured. Antennae as long as head and pronotum, first segment about twice as long as wide, second about as wide but noticeably shorter than first, third as long and as wide as first, fourth through tenth increasing gradually in width but very little in length so tenth only slightly longer than wide, eleventh as wide as tenth and about twice as long.

Pronotum as wide as long, widest near middle, sides evenly arcuate, base and apex nearly straight, angles very narrowly rounded, surface micro-reticulate throughout, somewhat more coarsely and densely punctured than head, punctures separated by about their diameters. Elytra conjointly twice as long as wide, slightly wider apically, sides straight from broadly rounded humeri to rounded outer apical angles, thence slightly arcuate to rounded inner apical angles; surface sculptured and punctured much like pronotum.

Abdomen finely reticulate, very finely, somewhat densely punctured above, more sparsely so beneath. Second visible tergite with a pair of small pale, very densely reticulate spots centerally.

Length, 2.2 mm.

This species is named in honor of Helen Moore.

Holotype: Sex unknown. "Mt. Wilson, Calif., 3-6-46, G. P. Mackenzie." [California Academy of Sciences].

BOOK REVIEWS

Although there are many books on drawing and art, few of them are of use in preparing illustrations for scientific publications. The following 3 books are reviewed to assist contributors to the *Coleopterists Bulletin* in improving the technical as well as the esthetic quality of their papers.

A handbook of biological illustration by Frances W. Zweifel. 1965. The University of Chicago Press, 131 p., 62 fig., 5¼"x8", paper $1.95. (Phoenix Science Series: PSS510).

Scientific illustration by Charles S. Papp. 1968. Wm. C. Brown Co., Dubuque, Iowa, 318 p., 1650 illus., 8½"x11", cloth $11.75.

Basic drawing for biology students by Emil G. Bethke. 1969. C. C. Thomas Publ. Co., Springfield, Ill., 100 p., 134 illus., 6¾"x9¾", cloth $7.00.

The order in which they are listed is also the order in which I recommend them, although the first 2 are a "toss up." The Zweifel book is small, but there is a wealth of concise information with selected examples. With its low cost, it should be on the shelf of every author (alongside the *Style Manual for Biological Journals*).

The second book is by Charles Papp, a coleopterist known to many of our readers. It is highly recommended because of the great number of beautiful examples of techniques, including many beetle drawings. The text is primarily a series of explanations of the figures. Although the English is an improvement over a 1963 edition, it is not up to the high quality of the illustrations. Papp is a "Scientific illustrator" which he distinguishes from an "artist" who has greater freedom of expression.

The final book by Bethke is the most recent, and, for its small size, much overpriced. The author-artist is an ophthalmologist who approaches drawings more as a beginning art teacher might. Stress is placed on sketching, proportion, and perspective. However, there are few finished examples and none of fine detail like those in the 2 previous books.

Any approach to scientific illustration can be of value in certain situations. I would therefore suggest getting all the books and aids which the author can afford. I believe that the first 2 books are as important to anyone publishing papers with illustrations as a text is to a student. He can always borrow a copy from the library, but he will miss a great deal if he doesn't have his own copy. Every taxonomist should become familiar with the basic techniques of illustration, and at least one book such as those reviewed above is indispensable. (R. E. Woodruff).

BEETLE TALK

Only when one takes on an editorial job does he realize the time and effort which must go into producing every scientific journal. The *Coleopterists Bulletin* has been fortunate through the years to have had devoted people willing to sacrifice their own work to get out the *Bulletin.* I would like to take this opportunity to thank Dr. N. M. Downie for his past 4 years of editorship, and to the previous 3 editors (Ross H. Arnett, Jr., R. E. Blackwelder, and T. J. Spilman) for their service to the *Bulletin.* Twenty-five years of continuous publication with high quality standards is a permanent record that their jobs were well done.

A NEW SPECIES OF *ELSIANUS* FROM TEXAS AND MEXICO, WITH RECORDS OF OTHER SPECIES IN THE UNITED STATES (COLEOPTERA: DRYOPOIDEA: ELMIDAE).

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Abstract

Records of the 2 U.S. species, *Elsianus moestus* (Horn) and *E. texanus* Schaeffer, are cited from Arizona, Texas, New Mexico, and Coahuila, Mexico. *E. shoemakei* n. sp. is described from Del Rio, Texas (type locality) and El Cariño (25 mi. west of Monclova), Coahuila, Mexico. It is smaller than any species known from Mexico or the United States (3.1-3.8 mm long and 1.2-1.5 mm wide), possesses unique genitalia, and differs in other details from previously known species. It seems closest to *E. striatus* Sharp.

Introduction

Two species of *Elsianus* have been reported previously from the United States: *E. moestus* (Horn) (1870), originally included in the genus *Elmis*, described from the San Pedro River in Arizona, and *E. texanus* Schaeffer (1911), from Devil's River, Texas (Sanderson 1953-54). Each was described from a single specimen. I have encountered no subsequent records of *E. moestus*, although I have collected specimens (apparently representing this species) from several localities in Arizona (2 from the Rio San Pedro in Cochise Co., 22-VIII-67 which, unfortunately, were lost; 1 adult and 2 larvae from Bloody Basin, Yavapai Co., 18-IV-69; 2 from the East Verde River near Payson in Gila Co., 8-VII-69). The only other published records of *E. texanus* I have seen are those of Burke (1963), who reported it from Devil's River in the vicinity of the Highway 90 bridge and from a small stream 5 miles east of Camp Wood, Texas. I have collected it from both of these sites (that portion of Devil's River is no longer suitable habitat, as a result of the construction of a large dam), and from the following additional localities in Texas: Devil's River further upstream, Val Verde Co.; San Marcos River, Hays Co.; Limpia Canyon, Jeff Davis Co.; Guadalupe River, Kerr Co.; Blanco River, Hays Co.; Nueces River, Uvalde Co.; San Saba River, Menard Co.; Onion Creek, Travis Co. I have also collected *E. texanus* at Sitting Bull Falls, Eddy Co., New Mexico, as has Clark W. Beasley, and at a number of sites in Coahuila, Mexico between Ciudad Acuña, Piedras Negras, and Ciudad Allende.

All of these streams appear to have a high calcium content, in many cases with typical travertine deposits. Since *E. texanus* shares this habitat with the limnichid, *Lutrochus luteus* LeConte, it might reasonably be sought in the other localities listed for *Lutrochus* by Brown and Stoaks (1970). The late instar larvae of *E. texanus* seem relatively tolerant of adverse environmental conditions; one is alive at this writing, after more than 20 months on my desk in a 2 oz plastic jar containing a travertine encrusted pebble from its original habitat in Devil's River and kept in water no more than a few millimeters deep.

In Mexico, 6 other species of *Elsianus* have been recorded: *E. grandis* Hinton, *E. graniger* Sharp, *E. sandersoni* Hinton, *E. scutellaris* Hinton, *E. striatoides* Hinton, and *E. striatus* Sharp (Blackwelder 1944, Hinton 1940). All of these reports are from the states of Mexico and Morelos in central Mexico. Several other species are known from other Central American countries, and many more from South America. Among specimens I have collected, there are additional undescribed species, but I am sending all this material to Dr. H. E. Hinton, who is undertaking a revision of the genus. With apologies to him, but because of a prior commitment, I am here describing one new species which I have found in considerable numbers in San Felipe Creek within the city of Del Rio, Texas and in the Rio Salado west of Monclova, Coahuila, Mexico. Both of these streams are delightfully clean and clear.

I take pleasure in naming this new species in honor of Mr. Charles M. Shoemake, who assisted and accompanied me on many dryopoid collecting trips in Oklahoma and on my first expedition to Mexico.

Elsianus shoemakei Brown, NEW SPECIES

(Fig. 1-3)

Male: length 3.1 to 3.8 mm, width 1.2 to 1.5 mm. Cuticle granulate, shining, and black; antennae and tarsi rufous; palpi rufo-testaceous.

Head without distinct impressions; surface with granules subequal to facets of eyes, separated by about their own diameters. Antenna 11-segmented, basal segment longest, apical segment next longest; segments 2 to 4 decreasing in length, 4 or 5 to 10 increasing in length. Clypeus feebly and arcuately emarginate, with broadly rounded angles; sculptured like head, but with granules somewhat flatter. Anterior labrum margin straight medially, slightly arcuate toward sides, angles broadly rounded; sides and angles with both acute and blunt, testaceous hairs 30-45 μ long. Apical segment of maxillary palp ovate and almost as long as first 3 segments combined; galea and lacinia terminating in dense brushes of curved, medially-directed testaceous hairs or spines. Labial palp with apical segment subequal to that of maxillary palp. Mandible well developed, with 3 subacute apical teeth; prostheca large, membranous, flattened, bearing numerous fine hairs on its surface and about 5 prominent spines apically.

Pronotum broader than long (1.0 mm long, 1.15 mm wide), broader at base (1.0 mm) than apex (0.88 mm); broadest slightly behind middle. Sides arcuate, slightly sinuate just at base; apical margin broadly arcuate, deeply sinuate on each side above eyes; apical angles produced; lateral margin crenate, slightly explanate; basal margin bisinuate, emarginate before scutellum. Surface granulate, the granules very much like those on head; invested with short, fine, pale hairs. Sublateral carina flattened, obsolete near apex. Disc with no appreciable median longitudinal depression or gibbosity. Base, just anterior to scutellum, with a short, shallow depression, on each side of which is a small fovea.

Scutellum small, convex, almost circular but slightly acute at apex (about 0.17 mm wide); surface with granules and hairs as on pronotum.

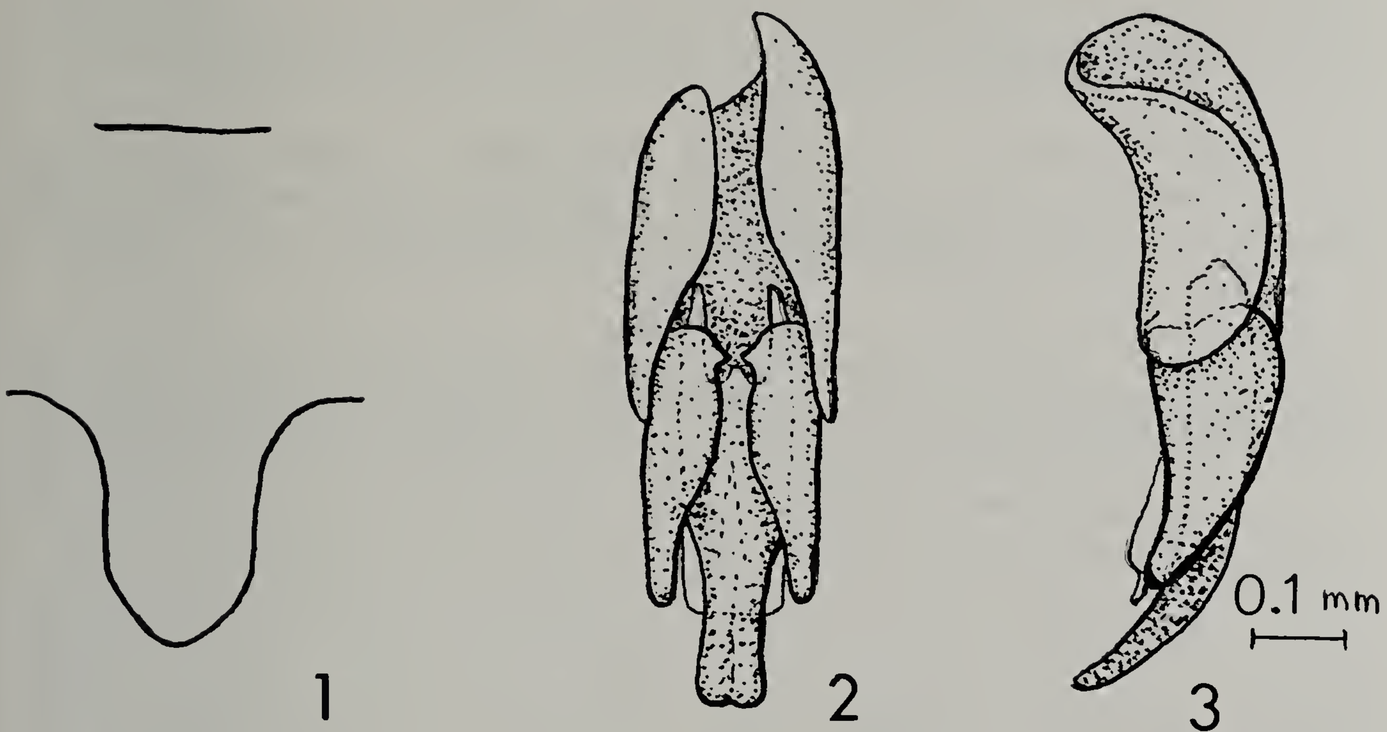

Fig. 1-3: *Elsianus shoemakei* n. sp. 1. Outline sketch of prosternal process (The transverse line above shows the relative position of the anterior prosternal margin). 2. Dorsal aspect of male genitalia. 3. Lateral aspect of male genitalia.

Elytra twice as long as width at humeri (2.5 mm long, 1.2 mm wide across humeri), the widest point (1.4 mm) near apical three-fifths. Lateral margins finely crenate, slightly explanate; apices feebly produced. Discal striae distinct, the punctures rather coarse; intervals flat to feebly convex. Surface granules less prominent to obsolete on disk, those toward sides and anterior comparable to pronotal granules, as are the hairs.

Prosternum (Fig. 1) with process bluntly rounded at apex and shallowly excavated at base; surface somewhat more coarsely granulate than pronotum. Mesosternum with a shallow transverse depression posterior to groove which receives prosternal process. Median depression of metasternum shallow, broad, and continuous with that of first abdominal sternite. Abdominal sternites without carinae. Surface of mesosternum, metasternum, and abdominal sternites coarsely granulate, with oblong granules. Postero-lateral margin of fifth abdominal sternite produced on each side to grasp elytra.

Genitalia (Fig. 2, 3) with median lobe elongate, flattened, decurved, and extending well beyond apices of parameres.

Female: externally similar to male.

Type: male in the Stovall Museum of Science and History, Norman, Oklahoma. UNITED STATES: San Felipe Creek in Del Rio, Val Verde County, Texas; elevation about 1,100 feet; 27-V-69, H. P. Brown.

Paratypes: 6 adults with same data as type; 15 adults at same locality 26-VIII-67; MEXICO: Rio Salado at El Cariño, Coahuila (about 25 miles west of Monclova), 35 adults, 17-VIII-70, H. P. Brown and 84 adults 3-IX-70, B. W. Miller. Paratypes will be deposited in the following collections: British Museum of Natural History, London; U. S. National Museum of Natural History, Washington; California Academy of Sciences, San Francisco; Illinois Natural History Survey, Urbana; University of Nevada, Las Vegas; and Stovall Museum of Science and History, Norman, Oklahoma. Numerous larvae were taken in association with the adults in each locality, but these have not been sorted to species (some of the larvae may well be those of *Elsianus texanus*).

Variation: aside from variation in size within the range given above, the only noted variation of potential significance was the shape of the prosternal process: apex subacute in some specimens, with relatively prominent apical angles.

Comparative notes: This new species is conspicuously smaller than either of the previously known U.S. species, being well under 4 mm long (averaging about 3.4 mm), whereas *E. texanus* and *E. moestus* range from about 4 to a little over 5 mm. In size, *E. shoemakei* is more comparable with *E. graniger* Sharp (1882), which ranges from 3.4 to 4.0 mm and occurs in Costa Rica and central Mexico, and *E. striatus* Sharp (1882), which ranges from 3.3 to 4.5 mm and occurs in Guatemala and central Mexico. From *E. graniger* it differs in lacking a prominent pronotal gibbosity anterior to the scutellum, and from *E. striatus* it differs in being much more slender (greatest width 1.2-1.5 mm, in contrast with 1.5-1.8 mm). From these and all other known species, *E. shoemakei* differs in details of the male genitalia. It appears to be closest to *E. striatus*.

In Hinton's (1940) key to the Mexican species of *Elsianus* on page 264, *E. shoemakei* would key to *E. striatus*. The key may be adapted to include it with the following changes: in the first half of couplet 4, delete everything after the word "tarsi" and insert the guide numeral 6.

At the end of the key, add couplet 6 as follows:

6(4). Male genitalia with median lobe barely extending beyond apices of parameres, in dorsal aspect with apical fourth slender, no broader than either paramere. GUATEMALA, MEXICO .... *E. striatus* Sharp

6′. Male genitalia with median lobe projecting conspicuously beyond apices of parameres, in dorsal aspect with apical fourth fully twice as broad as either paramere. UNITED STATES (Texas), MEXICO (Coahuila) .... *E. shoemakei* Brown, n. sp.

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NOTES AND OBSERVATIONS ON LEPTURINI IN NEW ENGLAND (COLEOPTERA: CERAMBYCIDAE)

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Abstract

Eight years of collection and host plant data are presented for 54 species of the tribe Lepturini. These records are from: Moosehead Lake, Maine; Durham, New Hampshire; and Fall River, Massachusetts.

Eight years of collection, observation, and literature review have yielded the following information on Lepturini in New England. The majority of observations were made near Moosehead Lake (1), in west-central Maine; other observations were made in the areas of Durham, New Hampshire (2), and Fall River, Massachusetts (3). Records are cited by these numbers in the following list. Information also has been taken from the collections of the Universities of Maine, New Hampshire, and Massachusetts.

The nomenclature of this list follows that of Swaine and Hopping (1928), Hopping (1937) and is supplemented with the other sources listed. Names of all plants were taken from Fernald (1950). Scarce indicates that adults were found in very small numbers; common indicates that they were generally plentiful.

Pseudopachyta rugipennis Newman (1 & 2, scarce). Host plant: dead pine (Swaine & Hopping 1928). Found under the bark of dead and dying *Pinus strobus* L.

Pidonia aurata (Horn) (2, scarce).

Pidonia ruficollis (Say) (1,2, & 3, common). Frequents flowers of *Geranium maculatum* L. (Knull 1946), *Viburnum cassinoides* L., *Cornus stolonifera* Michx., *Cornus alternifolia* L., and *Pyrus americana* (Marsh.) DC.

Idiopidonia pedalis (LeConte) (1, 2, 3, scarce).

Grammoptera exigua (Newman) (3, scarce).

Grammoptera haematites (Newman) (2 & 3, scarce). Frequents flowers of *Cornus alternifolia* L.

Grammoptera subargentata (Kirby) (1, 2, & 3, common). Found on flowers of *Viburnum cassinoides* L. *Cornus stolonifera* Michx., *Cornus alternifolia* L., *Pyrus americana* (Marsh.) DC., and *Spirea latifolia* (Ait.) Borkh.

Grammoptera ruficeps (LeConte) (2 & 3, scarce). Taken on flowers of *Viburnum cassinoides* L.

Alosterna capitata (Newman) (1, 2, 3, scarce). Frequents flowers of *Viburnum cassinoides* L., *Cornus alternifolia* L. and *Pyrus americana* (Marsh.) DC.

Leptura emarginata Fabricius (3, scarce). Host plants: *Castanea, Ulmus, Fagus, Quercus, Nyssa,* and *Betula* (Swaine & Hopping 1928). Adults may be easily taken by use of fermenting bait (Knull 1946).

Leptura subhamata Randall (1, 2, & 3, scarce). Host plants: *Tsuga* and *Pinus*. Taken on logs of *Fagus* and *Quercus* (Wickham 1897). Taken on *Spirea latifolia* (Ait.) Borkh.

Leptura plebeja Randall (1, 2, & 3, scarce). Taken on *Spiraea latifolia* (Ait.) Borkh.

Leptura lineola Say (1, 2, & 3, common). Host plant: *Betula* (Swaine & Hopping 1928). Breeds in dead birch stumps and dead ironwood (Knull 1946). Taken on flowers of *Rubus alleghaniensis* Porter (Blackman 1918), *Spiraea latifolia* (Ait.) Borkh., *Cornus stolonifera* Michx., and *Viburnum.*

Typocerus acuticauda Casey (1 & 3, scarce).

Typocerus zebra (Olivier) (2, scarce). Host plants: dead stumps of the genus *Pinus* (Swaine & Hopping 1928); mines oaks (Beutenmuller 1896). Adults are found on flowers, especially *Rhus* spp. (Dillon 1961).

Typocerus velutinus (Olivier) (1, 2, & 3, common). Host plants: decaying hardwoods and conifers (Swaine & Hopping 1928). Reared from decayed *Betula alleghaniensis* Britton (Knull 1946). Taken on *Spiraea latifolia* (Ait.) Borkh.

Typocerus sinuatus (Newman) (3, scarce).

Anoplodera nigrella (Say) (1&2, scarce). Recorded as breeding in dead pine (Knull 1946). Host plants: *Pinus* and *Picea* (Swaine & Hopping 1928). Found ovipositing on spruce-fir pulpwood.

Anoplodera sexmaculata (Linnaeus) (1, 2, & 3, scarce). Found on flowers of *Viburnum cassinoides* L., *Pyrus americana* (Marsh.) DC., *Rubus alleghaniensis* Porter, *Achillea millefolium* L., and *Chrysanthemum leucanthemum* L.

Anoplodera cordifera (Olivier) (1, 2, & 3, common). Found on *Spiraea latifolia* (Ait.) Borkh.

Anoplodera nitens (Forster) (1, 2, & 3, common). Host plants: *Quercus, Castanea, Juglans* (Swaine & Hopping 1928), and *Quercus velutina* Lam. (Wickham 1897). Larvae mine beneath bark at bases of trees. Reared from decayed *Acer saccharum* Marsh. (Knull 1946)

Anoplodera octonotata (Say) (3, scarce).

Anoplodera mutabilis (Newman) (1, 2, & 3, common). Breeds in numerous decaying hardwoods (Dillon 1961) including *Quercus, Betula, Acer, Castanea, Fagus* (Swaine & Hopping 1928), ironwood, *Alnus, Populus, Salix, Prunus serotina* Ehrh., and *Betula nigra* L. (Knull 1946). Found on flowers of *Rubus alleghaniensis* Porter (Blackman 1918), *Pyrus americana* (Marsh.) DC, *Cornus stolonifera* Michx., *Viburnum trilobum* Marsh., *Viburnum cassinoides* L., *Chrysanthemum leucanthemum* L., and *Spiraea latifolia* (Ait.) Borkh.

Anoplodera sanguinea LeConte (1 & 2, scarce). Taken on flowers of *Viburnum cassinoides* L., *Viburnum trilobum* Marsh., *Cornus stolonifera* Michx., *Chrysanthemum leucanthemum* L., and *Achillea millefolium* L.

Anoplodera biforis (Newman) (1, 2, & 3, scarce). Host plant: *Castanea* (Swaine & Hopping 1928). Taken on spruce-fir pulpwood. Frequents *Spiraea* (Blackman 1918).

Anoplodera proxima (Say) (1, 2, & 3, common). Host plants: *Acer, Hicoria, Castanea,* and *Tilia* (Swaine & Hopping 1928). Reared from *Acer* (Wickham 1897). Taken on *Sambucus canadensis* L., *Chrysanthemum leucanthemum* L., and *Spirea latifolia* (Ait.) Borkh.

Anoplodera minnesotana (Casey) (1, 2, & 3, common). Same as *A. proxima* (Say).

Anoplodera canadensis (Olivier) (1, 2, & 3, Common). Host plants: *Tsuga* (Swaine & Hopping 1928, Wickham 1897). *Pinus, Picea, Pinus strobus* L. (Swaine & Hopping 1928). Found ovipositing on spruce-fir pulpwood. Taken on *Spiraea latifolia* (Ait.) Borkh., *Solidago* spp., and *Eupatorium purpureum* L.

Anoplodera chrysocoma (Kirby) (1, 2, & 3, common). Host plants: *Pinus* spp. (Swaine & Hopping 1928). Taken on flowers of *Viburnum cassinoides* L., *Pyrus americana* (Marsh.) DC., *Cornus stolonifera* Michx., *Chrysanthemum leucanthemum* L., *Rubus alleghaniensis* Porter, and *Achillea millefolium* L.

Anoplodera rubrica (Say) (1, 2, & 3, common). Host plants: hardwoods and conifers (Swaine & Hopping 1928). Taken on *Spiraea latifolia* (Ait.) Borkh. and *Sorbaria sorbifolia* (L.) A. Br.

Anoplodera vagans (Olivier) (1, 2, & 3, common). Host plants: hickory and birch (Knull, 1946), *Pinus* (Swaine & Hopping 1928), *Betula alleghaniensis* Britton and *Carya ovalis* (Wangenh.) Sarg. (Wickham 1897). Taken on *Spiraea latifolia* (Ait.) Borkh. and *Sorbaria sorbifolia* (L.) A. Br.

Anoplodera circumdata (Olivier) (2 & 3, common). Taken on *Spiraea* (Blackman 1918), *Viburnum cassinoides* L., and *Cornus stolonifera* Michx.

Anoplodera pubera (Say) (1, 2, & 3, common). Taken on *Rubus alleghaniensis* Porter (Blackman 1918), *Viburnum cassinoides* L., *Cornus alternifolia* L., *Cornus stolonifera* Michx., *Pyrus americana* (Marsh.) DC., *Spiraea latifolia* (Ait.) Borkh. and *Rosa* spp.

Anoplodera vittata (Swederus) (1, 2, & 3, common). Host plants: *Abies, Pinus, Juniperus, Castanea,* and *Larix* (Swaine & Hopping 1928) as well as other conifers and hardwoods (Dillon 1961). Taken on flowers of *Viburnum cassinoides* L., *Sambucus canadensis* L., *Chrysanthemum leucanthemum* L., *Spiraea latifolia* (Ait.) Borkh., and *Sorbaria sorbifolia* (L.) A. Br.

Encyclops coerulea (Say) (1 & 2, scarce). Knocked from dead cedar needles (Nicolay 1917). Recorded as breeding in the outer bark of living *Quercus alba, Acer, Castanea, Nyssa, Fraxinus nigra* Marsh., and *Carya ovalis* (Wangenh.) Sarg. (Knull 1946). Taken on flowers of *Cornus alternifolia* L.

Toxotus vittiger (Randall) (1, 2, & 3, scarce). Frequents flowers of *Hydrangea arborescens* L. and *Viburnum acerifolium* L. (Knull 1946).

Toxotus schaumi (LeConte) (3, scarce).

Stenocorus inquisitor (Linnaeus) (1, 2, & 3, common). Host plants: *Pinus, Abies, Tsuga, Larix* (Hopping 1947) and *Picea* (Beutenmuller 1896). Taken under bark of dead *Pinus* logs and stumps.

Centrodera decolorata (Harris) (1, 2, & 3, scarce). Host plants: *Quercus* and *Castanea* (Knull 1946). Occurs on *Fagus* (Procter 1946, Wickham 1897) and *Acer* (Procter 1946). Occasionally taken with black light trap.

Anthophylax malachiticus (Haldeman) (1, 2, & 3, scarce). Frequents *Picea* (Procter 1946). May be taken on flowers of *Cornus* and *Acer spicatum* Lam. (Knull 1946).

Anthophylax viridis (LeConte) (1, 2, & 3, scarce). Frequents flowers of *Acer spicatum* Lam. (Knull 1946).

Anthophylax attenuatus (Haldeman) (1, 2, & 3, scarce). Reared from green branches of *Picea glauca* (Moench) Voss. (Procter 1946). Recorded as breeding in decayed *Fagus* (Knull 1946; Wickham 1897), *Acer, Populus,* and *Betula* (Knull 1946).

Evodinus monticola (Randall) (1 & 2, common). Recorded as breeding under bark of dead *Tsuga* trunks (Knull 1946, Procter 1946). Taken on flowers of *Rubus alleghaniensis* Porter (Blackman 1918), *Viburnum cassinoides* L., *Viburnum trilobum* Marsh., *Cornus stolonifera* Michx., *Prunus* spp., *Pyrus americana* (Marsh.) DC., *Chrysanthemum leucanthemum* L., and *Spiraea latifolia* (Ait.) Borkh.

Gaurotes cyanipennis (Say) (1, 2, & 3, scarce). Recorded as breeding in *Cornus, Juglans, Quercus, Prunus, Nyssa, Rhus* (Knull 1946), and *Betula* (Wickham 1897). Taken on flowers of *Rhus* (Wickham 1897) and *Cornus alternifolia* L.

Gaurotes abdominalis Bland (1, scarce). Frequents flowers (Procter 1946).

Acmaeops pratensis (Laicharting) (1, 2, & 3, common). Taken on pine lumber (Wickham 1897) and spruce-fir pulpwood. Frequents flowers of *Viburnum cassinoides* L., *Pyrus americana* (Marsh.) DC., *Chrysanthemum leucanthemum* L. and *Achillea millefolium* L.

Acmaeops proteus (Kirby) (1, 2, & 3, scarce). Taken on pine lumber (Wickham 1897) and spruce-fir pulpwood. Taken by beating dead pine needles (Nicolay 1917). Frequents flowers of *Viburnum cassinoides* L., *Pyrus americana* (Marsh.) DC., *Chrysanthemum leucanthemum* L., and *Achillea millefolium* L.

Acmaeops thoracicus (Haldeman) (2, scarce). May be a variety of *A. bivittatus* (Say) (Knull 1946).

Acmaeops bivittatus (Say) (2, scarce).

Bellamira scalaris (Say) (1, 2, & 3, scarce). Larvae have been found in many hardwood and coniferous trees (Procter 1946). Lives in *Betula alleghaniensis* Britton (Blackman 1918). Frequents *Spiraea latifolia* (Ait.) Borkh.

Strangalina acuminata (Olivier) (2 & 3, scarce). Recorded as breeding in dead ironwood, *Alnus, Physocarpus,* and *Viburnum* (Knull 1946). Found on flowers of *Sorbaria sorbifolia* (L.) A. Br.

Strangalina famelica (Newman) (3, scarce). Recorded as breeding in decayed *Betula alleghaniensis* Britton and *Quercus* (Knull 1946). Found on flowers, especially *Rosa* spp. (Knull 1946).

Strangalina bicolor (Swederus) (3, scarce). Recorded as breeding in dead *Acer* and *Quercus* (Knull 1946). Frequents flowers, especially *Rosa* spp. (Knull 1946).

Strangalina luteicornis (Fabricius) (2 & 3, common). Recorded as breeding in decayed *Viburnum dentatum* L., *Vitis, Fagus,* and *Ulmus* (Knull 1946). Adults are abundant on flowers of *Rhus glabra* L. (Knull 1946) and *Spiraea latifolia* (Ait.) Borkh.

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OBSERVATIONS ON THE LIFE HISTORY AND HABITS OF *ENDALUS CELATUS* BURKE (COLEOPTERA: CURCULIONIDAE)[1]

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Abstract

The life history and habits of *Endalus celatus* Burke on *Marsilea mucronata* A. Br. in Texas are discussed. Eggs are deposited in the sporocarps of this plant, with the developing larvae feeding on the spores. Pupation occurs in the larval feeding cavity. The weevil larvae are parasitized by *Trimeromicrus* sp. (Pteromalidae) and *Bracon punctatus* (Mues.) (Braconidae). Photographs are provided for the adult, larval, and pupal stages of the weevil and the host plant.

Endalus celatus was originally described from a single male collected at College Station, Texas (Burke 1961). Approximately 2 years later a female of the species was taken near Alamo, Hidalgo Co., in southern Texas (Burke 1965). Despite the striking secondary sexual differences and the fact that the sexes had not been taken together, there was little doubt that these specimens were conspecific. Because of the peculiar rostral and dorsal setae which it bears (Fig. 1, 2), *E. celatus* is the most easily recognized member of the genus. Both of the specimens mentioned above were collected by sweeping mixed vegetation around small ponds. Attempts to obtain additional specimens and to learn something about the life history, habits, and host of the species were unsuccessful until June 1969.

At that time 3 specimens were collected while sweeping emergent vegetation in a small pond near Corpus Christi, Texas. Plants of the genus *Marsilea* (Pteridophyta, Marsileaceae) were abundant in the area, but it could not be determined then if the weevils came from these plants. The following year *Marsilea mucronata* A. Br. near College Station was examined periodically for evidence of weevil association. Adult weevils were finally found on May 20 at the bases of these plants and numerous specimens were subsequently reared from the sporocarps. The abundance of both plants and weevils presented us an excellent opportunity to make observations on the life history and habits of the latter. Little is known about the biology of weevils of the genus *Endalus* and, to our knowledge, no weevil species has heretofore been reported to be associated with *Marsilea.*

Endalus celatus is presently known only from Texas. Weevils have been collected in the south, central, and northwestern areas of the state. Now that the host has been found, additional collecting in likely areas will undoubtedly increase the known range of the weevil.

Correll and Johnston (1970) recognized 5 species of *Marsilea* in Texas. Several other species occur elsewhere in North America. The fronds of *Marsilea mucronata* resemble the leaves of a four-leaf clover (Fig. 3). The sporocarps are borne either at or near the soil or water level or on peduncles up to 2 inches above the surface. In the area where most of our observations were made, *M. mucronata* grows mostly along the banks of the river immediately adjacent to the water. Sometimes dense mats of these plants cover still, shallow water and bare mud and rocks on the shore.

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[2] Graduate College Fellow and Professor, respectively.

Adult weevils may be found during the day at the bases or among the roots of the plants. After dusk they ascend the plants and come to rest on the petioles and fronds. Adults feed by chewing notches in the edges of the fronds. They were probably active prior to the May 20 date as we had not yet learned where to look for them.

Female weevils chew an opening in the side of the sporocarp through which they deposit the eggs. The eggs are placed between the rows of sporangia on each valve of the sporocarp. The number of eggs deposited in the sporocarp varies from 1 to 6, and all appear to be inserted through the same hole. Eggs and medium-size larvae are sometimes found in the same sporocarp, indicating that multiple egg depositions may occur. The oviposition puncture is sealed by the female after egg deposition is completed. The first eggs and larvae were found on June 16, but plant growth had been delayed by extensive flooding of the river that spring, probably delaying weevil development.

After hatching, the young larva begins feeding on the spores in 1 valve of the sporocarp. If several larvae are present they may consume all of the spores in the valve. There are usually 2 or 3 larvae (Fig. 4) in each

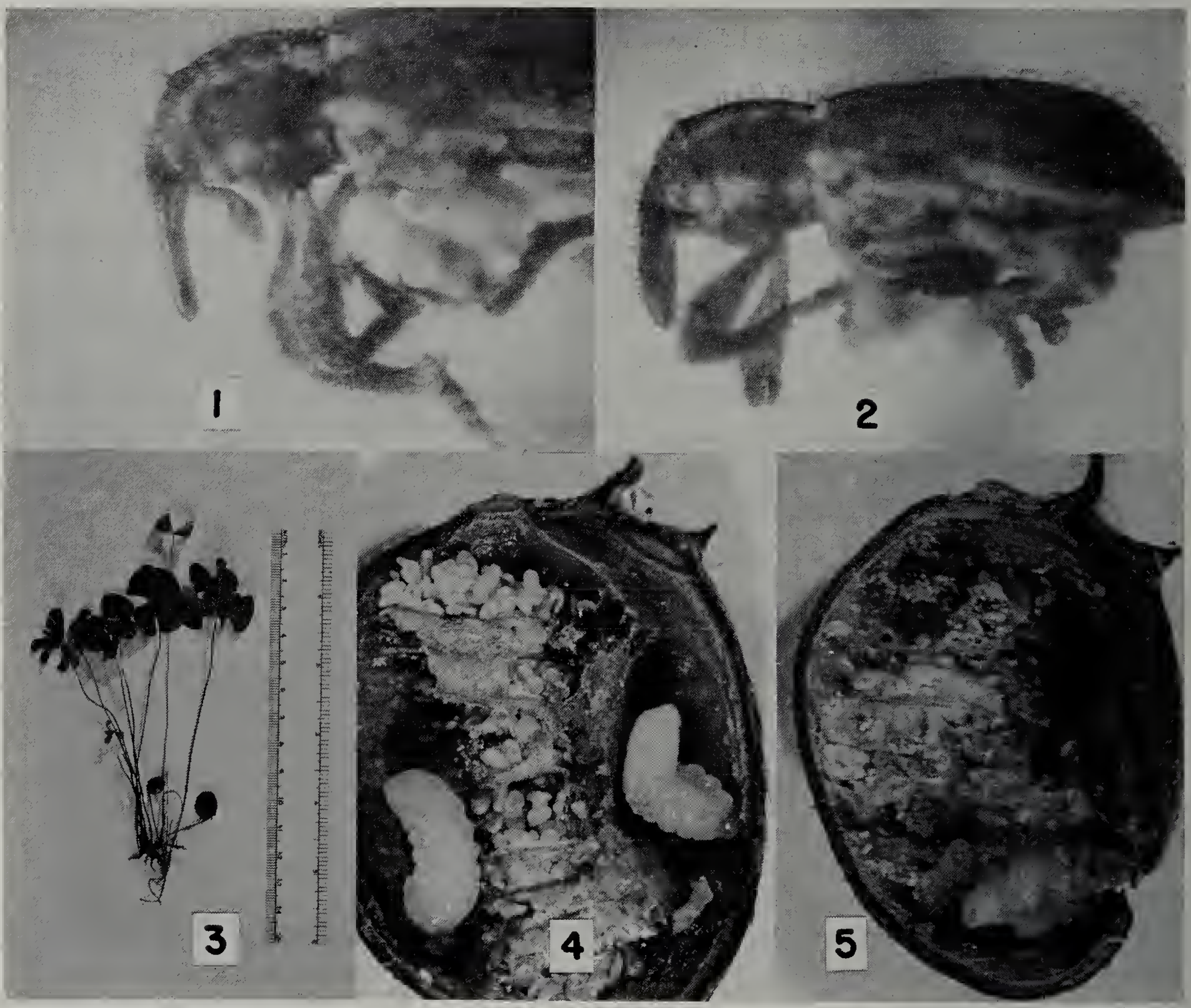

Fig. 1-2, 4-5: *Endalus celatus*, 1) female, 2) male, 4) larvae in sporocarp of *M. mucronata*, 5) pupa in sporocarp of *M. mucronata.*

Fig. 3: The host plant: *Marsilea mucronata.*

sporocarp but as many as 5 have been observed. Three larval instars have been observed, each of which has an average duration of about 5 days. The maximum duration observed for the last instar was about 10 days.

Pupation occurs within the cavity formed by the feeding of the larva (Fig. 5). The minimum duration observed for the pupal stage was 3 days; the maximum 7 days. The newly emerged adult remains quiescent in the sporocarp for about 1 day, after which time it usually exits through the original oviposition hole. In cases where there are several individuals in each sporocarp, other exit holes may be made by the adults.

We found *Trimeromicrus* sp. (Pteromalidae) (det. B. D. Burks, USDA) and *Bracon punctatus* (Mues.) (Braconidae) (det. P. M. Marsh, USDA) to be parasitic on the weevil larvae. The pteromalid was by far the most abundant, constituting nearly 70% of the parasites reared. Oviposition by the wasps was not observed. We did find, in the sporocarps, eggs which were presumably those deposited by the parasites. These eggs had been placed on the sporangia near the egg or young larva of the weevil. Wasp larvae were observed to feed externally on the posterior region of weevil larvae. The pteromalid apparently attacks only a single larva but we observed the braconid attacking several weevil larvae in the same sporocarp. Both wasps pupate in the sporocarp near the remains of their hosts. Emergence is probably through the oviposition puncture of the weevil since no other exit holes have been seen. The frequency of parasitism varies greatly. About 60% of the first generation weevil larvae were parasitized, but parasitism dropped to about 10% in later generations.

Endalus celatus has several generations each year. There are indications that these overlap considerably. *Marsilea mucronata* spreads vegetatively during the entire growing season with new sporocarps continuously being formed throughout the period, insuring plentiful food for weevil larvae. The first sporocarps of the season were observed on June 16; the last on September 11.

Adults of other species of *Endalus* (*E. aeratus* LeC.; *E.* sp., near *aeratus* LeC.; and *E. setosus* LeC.) have been collected on *Marsilea mucronata* during this study, but the details of their biologies have not yet been worked out. Weevil larvae have been found mining fronds and boring in petioles and rhizoids. These are presumably larvae of one or more of the species of *Endalus* listed above, although attempts to rear them have not yet been successful. All other *Endalus* (*E. limatulus* (Gyll.), *E. punctatus* LeC., and *E. depressus* Burke)), for which host data are available are associated with plants of the family Cyperaceae. It is now evident that, on the basis of food plants, there are 2 species groups in the genus; this is supported to some extent by morphological characters.

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BOOK REVIEW

The serial literature of entomology; a descriptive study by Gloria M. Hammack. 1970. Entomological Society of America. 85 p. Cloth $2.00. Available from the Society, 4603 Calvert Rd., College Park, Md. 20740.

This volume is the result of grants to the Society from the National Science Foundation and contracted with the Biological Sciences Communication Project of George Washington University Medical Center. Although this list of periodicals or serials is more complete than any previously published, it has many glaring omissions (e.g., Proc. U.S. Nat. Mus.; Amer. Mus. Novitates; Bull. Amer. Mus; Fieldiana). Many old and defunct serials are missing, and only abbreviated information is given for defunct ones that are included.

The list is primarily the *core* serial literature, generally that which contains 25% or more articles relating to entomology. Titles are listed alphabetically by the first word of the title. Each entry contains where known: address of sponsor or publisher; description and nature of contents; language of text and summary or abstract; frequency; first year of publication (and last if ceased); major abstracting or indexing services covering it; average percent of articles on entomology; cost per year; and circulation figures.

The list is a useful bibliographic aid, but it appears to be much less complete than a taxonomist would wish. Perhaps the rush to get it published in time for the ESA meeting in Miami (Dec. 1970) was primarily responsible for the incompleteness. The reviewer hopes that an early revised edition will rectify the situation. (R. E. Woodruff)

BOOK NOTICES

The following books are listed because of the current interest in ecology and man's impact on the environment. I am sure every beetle collector has seen many of his favorite collecting sites modified or destroyed within a short time period. Space does not permit individual reviews here, but those listed are some of the better ones from the recent deluge of such books. We will list others as they come to our attention.

Biological conservation by D. W. Ehrenfeld, 1970. Holt, Rinehart, and Winston, Inc., 383 Madison Ave., New York, N.Y. 10017. 226 p.; many excellent black and white photos of habitats. Paper $3.95.

Man's impact on the global environment; assessment and recommendations for action, a report of SCEP (Study of Critical Environmental Problems). 1970. The MIT Press, Cambridge, Mass. 02138. 319 p. Paper $2.95.

The ecological context by John McHale. 1970. George Braziller, Inc., One Park Ave., New York, N.Y. 10016 188 p. Cloth $7.95.

Environment and man by Richard H. Wagner. 1971. W. W. Norton & Co., Inc., 55 Fifth Ave., New York, N. Y. 10003. 491 p. Cloth $7.50.

Agenda for survival ed. by Harold W. Helfrich, Jr. 1970. Yale University Press, 92a Yale Station, New Haven, Conn. 06520. 234 p. Cloth $7.50, paper $1.95.

The ecological conscience; values for survival ed by Robert Disch. 1970. Prentice-Hall Inc., 70 Fifth Ave., New York, N.Y. 10011. 206 p. Paper $2.45 (A Spectrum Book S-236).

The natural regulation of animal numbers by David Lack. 1971. Oxford University Press, 200 Madison Ave., New York, N. Y. 10016. 343 p. Paper $3.95.

New worlds for wildlife by Ann and Myron Sutton. 1970. Rand McNally & Co., Box 7600, Chicago, Ill. 60680. 190 p. 25 photos. Cloth $4.95.

HABITAT RELATIONSHIP AND SEASONAL ABUNDANCE OF FOUR SPECIES OF *EVARTHRUS* (COLEOPTERA: CARABIDAE)[1]

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Abstract

Seasonal occurrence and habitat preference of 4 species of *Evarthrus* ground beetles were studied during 1969-70 at Tall Timbers Research Station, Leon County, Florida. Pitfall traps, used to sample populations, indicated that the 4 species had a definite preference for a leaf-litter habitat. *Evarthrus ovulum* (Chaudoir) was the least specific in habitat preference and was the species most commonly collected during the winter months. All species showed definite seasonal patterns: *E. morio* (Dejean) probably overwinters as both larvae and adults; *E. ovulum* (Chaudoir) typically overwinters as adults; *E. sigillatus* (Say) and *E. laevipennis* (LeConte) typically overwinter as larvae.

Introduction

The genus *Evarthrus* LeConte, of the tribe Pterostichini, is North American in distribution; according to Ball (1960) it occurs in northern Mexico, southwestern and eastern United States, and southernmost Ontario. Members of this genus are some of the most commonly collected carabids in northern Florida. Although comparatively well-known taxonomically due to the work of Freitag (1969), there is little information on their habits. To meet this need, an ecological study was begun at the Tall Timbers Research Station, northern Leon County, Florida, in mid-1969. Seasonal distribution, habitat preference, and the effects of various factors on abundance were emphasized.

All species of the genus *Evarthrus* are flightless, having the hind wings atrophied and the elytra fused along the suture. Therefore, as indicated by Freitag (1969), most species have restricted ranges and are often allopatric. Of the 43 known species, 5 were taken in the collecting area at Tall Timbers; these were *Evarthrus morio* (Dejean), *E. laevipennis* (LeConte), *E. ovulum* (Chaudoir), *E. faber* (Germar), and *E. sigillatus* (Say). *E. faber* was taken only once at Tall Timbers and once near Monticello, Florida; the other 4 species were abundant enough in the collecting area to obtain ecological data.

According to the literature, ground beetles of this genus generally occur in dry woodlands and open fields at low altitude. Blatchley (1910) reported *Evarthrus seximpressus* (LeConte) occurring on dry, wooded slopes beneath logs and stones. Whitcomb and Bell (1964) reported *E. sigillatus*, *E. seximpressus*, and *E. sodalis* (LeConte) as predators in cotton fields. Kirk (1971) occasionally or rarely trapped *E. constrictus* (Say), *E. incisus* LeConte, *E. iowensis* Freitag, *E. substriatus* LeConte, and *E. torvus torvus*

[1] Florida Agricultural Experiment Stations Journal Series No. 3884.

LeConte in cropland in North Dakota. Freitag (1969) reported at least 15 species of *Evarthrus* in leaf litter, 6 in open places under cover, 4 in cornfields, and 1, *E. heros* (Say), in cotton fields. *E. blatchleyi* Casey was collected by Ball in a pitfall trap in an orange grove (Freitag 1969).

Almost nothing is known about the feeding habits of this genus. Freitag (1969) stated that most species are probably omnivorous. He found ant remains in *E. sodalis colossus* (LeConte) and spores of fungi in *E. faber*. Forbes (1883) dissected 7 specimens of *Evarthrus* and found that cankerworms, *Paleacrita vernata* (Peck), and other lepidopterous larvae formed 93% of the food present. Shough (1940) observed the feeding behavior of *E. sodalis* under caged conditions. He reported that they fought viciously with each other over bits of food thrown into the cage and often abandoned the food altogether while fighting. The beetles fed on small grasshopper nymphs, leafhoppers, stink bugs, and were very cannibalistic. The pentatomids were grasped at the corner of the pronotum and were completely consumed (with the exception of the elytra, wings, legs, and harder skeletal parts).

Methods and Materials

Pitfall traps are useful in determining abundance in a particular habitat and seasonal occurrence (Johnson, Lawrence, and Ellis 1966, Kirk 1971) but are ineffective for population estimates (Gilbert 1956, Greenslade 1964). With this in mind, a pitfall trapping study was begun in October, 1969, at Tall Timbers Research Station, northern Leon County, Florida. Each pitfall trap consisted of a 5 gal can buried to ground level and fitted with a narrow-rimmed funnel resting flush with the ground. The trap was 79.8 cm in circumference and 25.4 cm in diameter. A metal shield above excluded rain and debris. A pint jar (half-filled with 70% isopropyl alcohol) was used as a collecting container in the bottom of the can. This design permitted emptying the trap quickly with minor disturbance to the soil and vegetation surrounding it. The traps were emptied weekly. All samples were sorted as quickly as possible, and carabids were pinned and labeled.

In this region of north Florida, mixed forests of loblolly pine *Pinus taeda*; shortleaf pine, *P. echinata*; and longleaf pine, *P. palutris*, are annually burned as a management practice. Sections from which fire is excluded quickly change from open pine forests to dense growths of hardwood. Areas undisturbed for 60 years or longer tend to climax in beech-magnolia mesic forests or hammocks. This situation presents a wide variety of habitats. Two traps (15.2 m apart) were placed in each of 9 habitats. The 9 sampled areas included:

(A) Annually burned pine forest with herbaceous undergrowth approximately 1.5 m in height, characterized by *Desmodium* spp., *Cassia* spp., and related plants, with several composites present, especially *Solidago* spp.

(B) Annually burned pine forest with a grassy undergrowth approximately 1 ft high. The following plants were common: *Andropogon virginicus* Linn., *A. tener* (Nees) Kunth, *A. divergens* (Hack.) Anderss. ex Hitchc., and *Sorghastrum* sp.

(C) Biannually burned pine forest with a mixture of herbs and hardwood brush including oak, *Quercus* spp.; sassafras, *Sassafras albidum* (Nutt.) Nees; and sweet gum, *Liquidambar styraciflua* Linn.

(D) Pine forest unburned for 10 years, located on poor soil, and characterized by a sparse growth of hardwoods (oak, sweet gum, and hickory, *Carya* spp.) with some pines, both old and young. The canopy was somewhat open, with scattered grass among the leaf litter and pine needles.

(E) Pine forest unburned for 10 years, with a dense growth of loblolly pine saplings, a few hardwoods present, and blackberry vines, *Rubus* spp., common. The ground was heavily covered with a mat of pine needles.

(F) Pine forest unburned for 10 years, with a few scattered pine trees but consisting mostly of a thicket of young oaks; hickory; sassafras; dogwood, *Cornus florida* Linn.; and *Vaccinium* spp., with a closed canopy and the ground covered with heavy leaf litter.

(G) A mature mesic forest or hammock with a stand of magnolia, *Magnolia grandiflora* Linn.; beech, *Fagus grandifolia* Ehrh.; black gum, *Nyssa sylvatica* Marsh.; spruce pine, *Pinus glabra* Walt.; hornbeam, *Carpinus caroliniana* Walt.; and swamp chestnut oak, *Quercus michauxii* Nutt. Several species of fern were present; *Vitis* spp. and *Smilax* spp. lianas were numerous. The leaf litter which covered the ground consisted mostly of beech and magnolia leaves, with scattered rotting branches and logs.

(H) An abandoned cornfield planted in 1969 and harvested just before the first trapping; the weedy growth, which was heavy in 1970, consisted mostly of poorjoe, *Diodia teres* Walt.; pinweed, *Lechea villosa* Ell.; pineweed, *Hypericum gentianoides* (Linn.) BSP.; and horseweed, *Conyza canadensis* Linn. Other weeds included everlasting, *Gnaphalium obtusifolium* Linn., and goldenbush, *Haplopappus divaricatus* (Nutt.) Gray.

(I) An old field situation with a heavy growth of *Andropogon virginicus* Linn. and *Rubus* spp.

RESULTS

HABITAT SPECIFICITY: The 4 species of *Evarthrus* showed definite habitat preferences (Fig. 1), the number of each species varying sharply from one habitat to another. A total of 586 specimens was collected. All species were taken in more than 1 location: *E. ovulum* was taken in all 9 habitats; *E. morio* in 8; *E. sigillatus* in 4; and *E. laevipennis* in 3.

E. morio was particularly abundant in the 10-year unburned plot which had a thick growth of young hardwoods with heavy leaf litter on the ground; 132 *E. morio* were taken in this plot compared with a total of 23 from all other locations. None were taken in the abandoned cornfield; there was little difference in numbers of *E. morio* taken in the other 7 habitats.

E. laevipennis was abundant only in hardwood leaf-litter habitats. It was taken in numbers in the young hardwood areas, in the mature hammock, and in the unburned pine forest on poor soil; it was slightly less numerous in the latter. It was not taken in the unburned pine forest, where the ground cover was pine needles instead of hardwood leaf litter, or in any of the other locations.

Of the 4 species, *E. ovulum* showed the least habitat preference; several were taken in all areas sampled. The greatest numbers were taken in the areas unburned for 10 years; however, they were not abundant in the mature hammock but were numerous in the annually burned pine forest with a herbaceous undergrowth.

E. sigillatus showed a definite preference for hardwood leaf-litter habitats; it was taken in only 4 of the areas sampled. This species was numerous in the unburned plot with a thick growth of young hardwoods and in the mature hammock; 1 specimen was taken in the annually burned pine forest with a grassy undergrowth.

SEASONAL ABUNDANCE: The 4 species of *Evarthrus* had definite seasonal patterns of activity. Fig. 2 is a compilation of the numbers taken in all 18 pitfall traps in the 9 habitats and shows the numbers of each species taken each month of the year.

Carabids typically have one generation per year (Gilbert 1956, 1957). European carabids are broadly divided on the basis of overwintering as larvae or overwintering as adults (Lindroth 1949). This division may not apply to North America (Gilbert 1957).

Since teneral adults of *E. morio* were taken in large numbers in the spring peak and in smaller numbers in the fall peak, the possibility of 2 generations per year is indicated. Although *E. morio* is typically a larval overwinterer, a few adults may emerge in the fall and overwinter.

E. sigillatus had a similar seasonal pattern, but teneral adults were

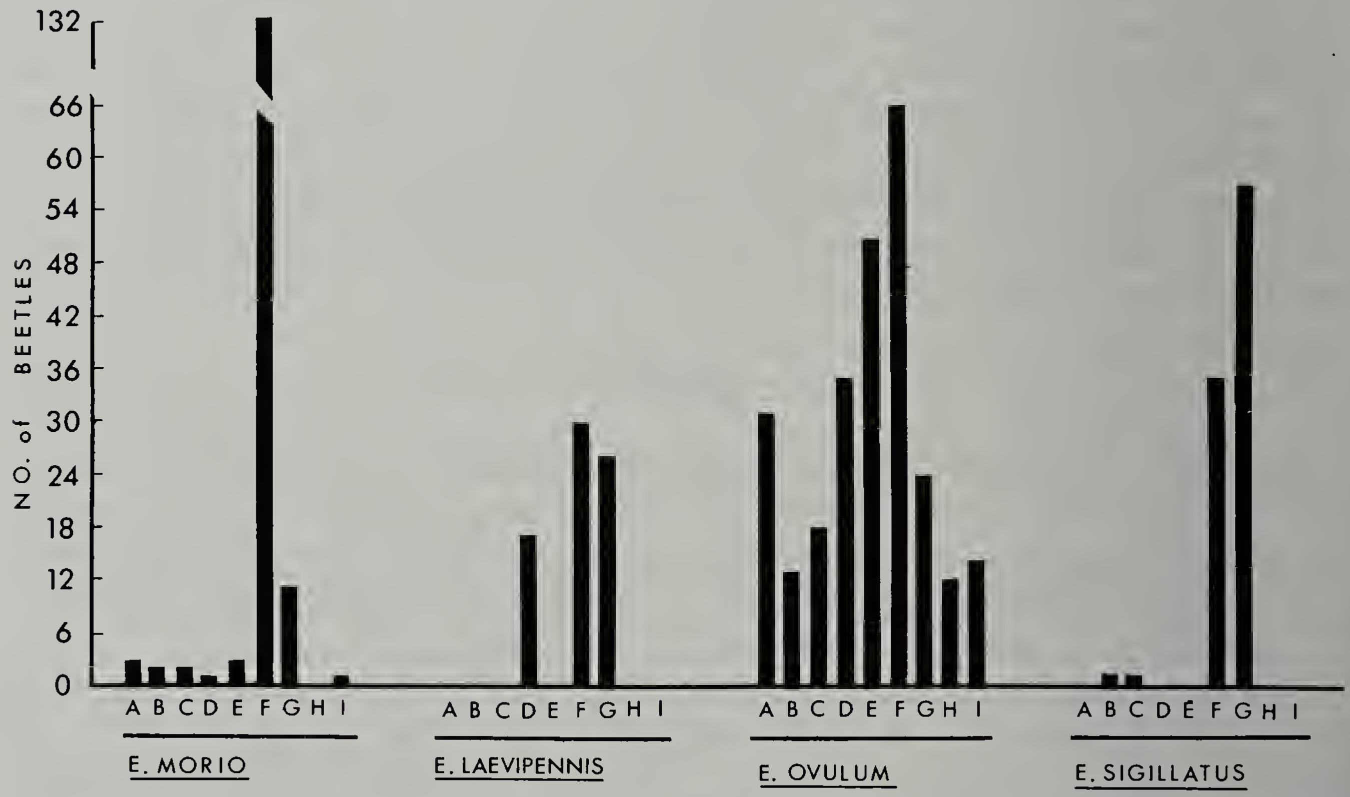

Fig. 1. Numbers of 4 species of *Evarthrus* trapped in different habitats (Oct., 1969-Sept., 1970), Tall Timbers Research Station, Leon Co., Fla. A. Annually burned pine forest; heavy growth of understory, especially weeds and legumes. B. Annually burned pine forest with low, grassy undergrowth. C. Biannually burned pine forest with a mixture of herbs and hardwoods. D. Pine forest unburned for 10 years on poor soil with a light growth of hardwoods, with light leaf litter. E. Pine forest unburned for 10 years with a heavy growth of young pines, few hardwoods, and pine needle ground cover. F. Pine forest unburned for 10 years, with heavy growth of young hardwoods and heavy leaf litter. G. Beech-magnolia hammock unburned for many years. H. Abandoned cornfield planted in 1969. I. An old field situation with a heavy growth of *Andropogon virginicus* Linn. and *Rubus* spp.

captured only in the spring. This suggests that they are mainly larval overwinterers, with a few adults living through the winter.

E. ovulum adults were absent during the entire summer. Teneral adults were taken from October into March, indicating that most overwinter as adults, with the possibility of a few "out of step" with the rest and emerging in the winter and spring.

Beginning in March, there was a steady increase in numbers of *E. laevipennis*, with a peak in July. Numbers of teneral adults followed the same pattern. One teneral adult was found in October and 1 in January. Probably only 1 generation per year occurs, although there is evidence of a more complex pattern of activity and of overwintering stages.

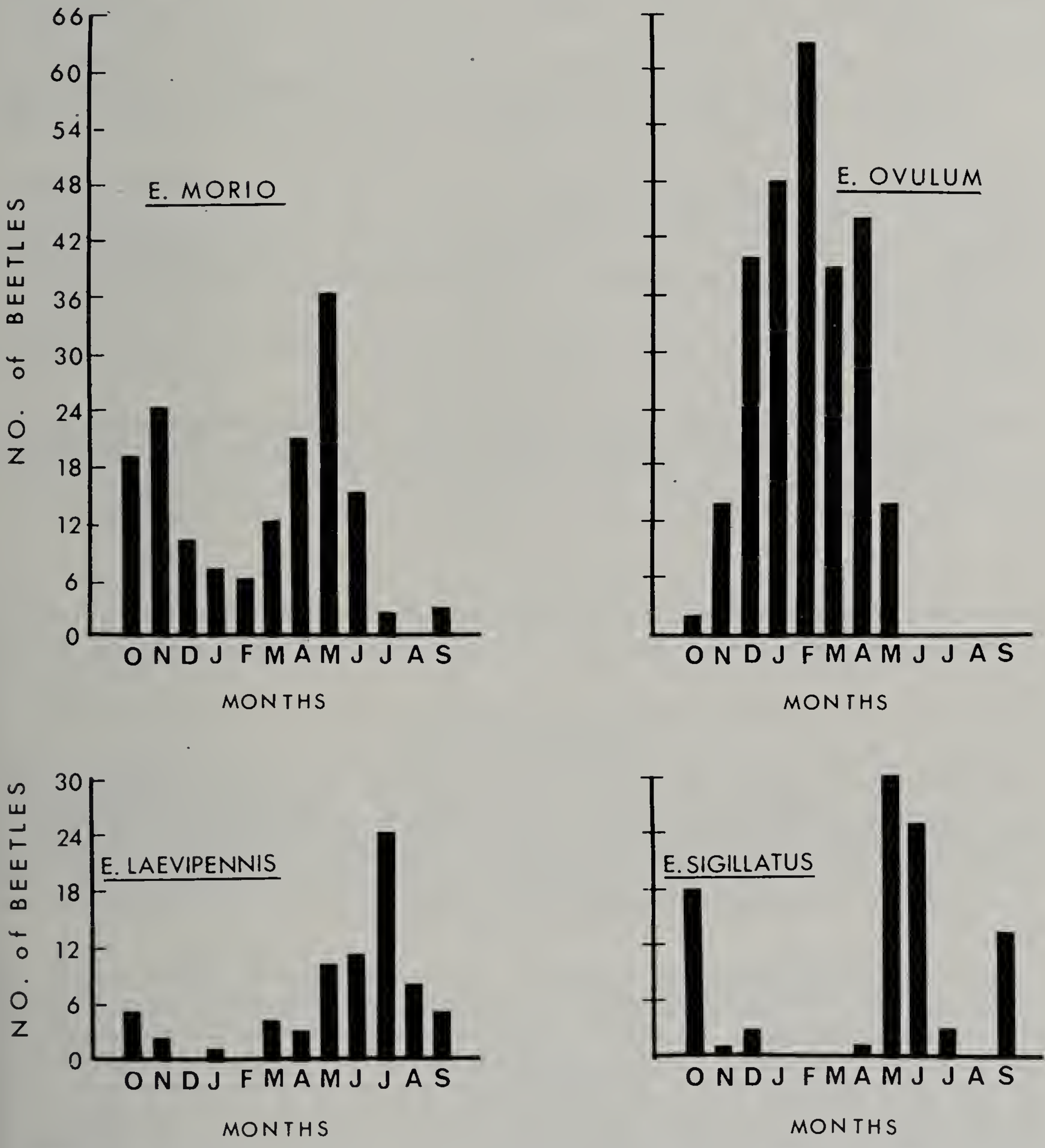

Fig. 2. Seasonal occurrence of 4 species of *Evarthrus* trapped in different habitats (Oct., 1969-Sept., 1970), Tall Timbers Research Station, Leon Co., Fla.

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BEETLE TALK

The Ross H. Arnett, Jr., Coleoptera collection (excluding Oedemeridae) was recently obtained by the Florida State Collection of Arthropods [FSCA], housed at the division of Plant Industry, Florida Department of Agriculture, P. O. Box 1269, Gainesville, Florida 32601. Requests for loans or returns of borrowed material should be sent to Dr. R. E. Woodruff at this address.

This valuable collection consists of approximately 60,000 specimens housed in 192 California Academy of Science type drawers and arranged in unit pinning trays. It will be gradually incorporated into the existing FSCA beetle collection. It is exceptionally rich in higher categories (i.e. families and genera). About 3,500 identified species are represented. Geographic areas well represented include southern Arizona, northeastern U.S. (particularly New York, Maryland, Virginia, and Indiana), Oklahoma, Ecuador and Galapagos Islands, and some of the West Indies. The private collections of J. Cottle (mainly California), J. N. Belkin, J. G. Franclemont, and E. D. McDonald are included. (R. E. Woodruff).

or counties listed. Dates are listed by day, month (in Roman numerals), and last 2 digits of the year. Listing of ecological data is encouraged. Location of specimens should be shown in brackets; if the data is extensive these should be abbreviated as shown and the abbreviations listed in the text.

Any article concerning Coleoptera will be considered. Descriptions of new taxa must contain keys (or be correlated with existing keys) and illustrations. All manuscripts should be typed on 8½x11" opaque white paper with 1 inch margins. They should be typed on one side only and double spaced throughout (including title, footnotes, tables, figure legends, and references). All scientific names should be underlined. Use the following order: title, author, author's address, abstract, body of text, references cited, and figures. All footnotes, tables, and figure legends should be provided on separate sheets and double spaced. Indicate approximate figure and table locations in pencil in the margin of the manuscript.

Abstracts should be a concise statement of the facts presented, not *that* they are presented (e.g. list names of organisms, not just that they were discussed or described as new). These abstracts are the key to how your article will be cited in the abstracting journals and should be carefully written.

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**Appointed by the Executive Committee at the Miami, Florida, meeting 29 Nov. 1970.

NOTICES

Notices to appear on this page are a free service to members and subscribers. Such copy will be limited to the back page, the older notices being moved up and replaced with the newest ones at the bottom. The editor reserves the right to reword such notices for brevity, consistency, and clarity.

STAPHYLINIDAE: Currently beginning study of taxonomy and morphology of larvae and adults of the Staphylinid subfamily Leptotyphlinae. Would like to borrow specimens in this group from North America primarily, but would welcome material from Central or South America. J. F. Cornell, Ass't Prof. of Biology. Appalachian State University, Boone, NC 28607.

TENEBRIONIDAE: Will exchange South American, Andean, and desert forms for any other groups of insects from Chile. Luis. D. Pena, G.P.O. Box 2974, Santiago, Chile.

CICINDELIDAE: Interested in obtaining specimens of **Cicindela trifasciata peruviana** from Peru and Ecuador. Will exchange for other Chilean species. Luis E. Pena, G.P.O. Box 2974, Santiago, Chile.

SCARABAEIDAE, CERAMBYCIDAE, LUCANIDAE: Goliath beetles, 14 different aberrations; 200 other species of beetles; for sale. Russell Dunn, Box 468, Sedona, AZ, 86336.

VIET NAM COLLECTION: Will exchange recently collected material from S.E. Asia for material from Southwestern U.S.A. Anyone wishing to determine material from this collection may keep the determined specimens. Bruce W. Miller, Dept. of Biological Sciences, Univ. of Nevada at Las Vegas, Las Vegas, NV 89109.

COLYDIIDAE: Revising the family for America north of Mexico. Wish to borrow material; will exchange for other Coleoptera. Karl H. Stephan, 3038 E. Eastland, Tucson, AZ 85716.

LIMNEBIIDAE: Revising the genus **Ochthebius** for North America. Desire material mounted or in alcohol. F. E. Wood, Dept. Ent., Univ. of Md., College Park, MD 20742.

Compiling check-list: Beetles of Clark Co., Nev. I would like to correspond with Coleopterists who have collected in southern Nevada. B. W. Miller, Dept. of Biol., Univ. of Nev. at Las Vegas, Las Vegas, NV 89109.

SWITZERLAND EXCHANGE: Interested in exchanging the following families: Cerambycidae, Carabidae, Lucanidae, Scarabaeidae (Cetoniinae, Goliathinae, Dynastinae). Ulysse Aubersan, 6 les prés du lac, 1400 yverdan VD, Switzerland.

BEETLE MITES: I am engaged in research on Paramegistidae which are phoretic on insects. They are known from Carabidae (**Scarites & Harpalus**), Scarabaeidae, Passalidae (in Australia), millipedes, and ants. Will exchange or purchase these mites in alcohol. W. J. Voss, Texas Tech. College, Dept. of Biology, Lubback, TX 79409.

SHARP & MUIR: THE COMPARATIVE ANATOMY OF THE MALE GENITAL TUBE IN COLEOPTERA. The classic 1912 monograph and 6 other papers by the same authors, 304 p., 43 pl., bound; $10.00. An essential book for all coleopterists. Entomological Society of America, 4603 Calvert Rd., College Park, MD 20740.

FOR SALE: Casey, T. L. 1910-24. **Memoirs on the Coleoptera** (I-XI); complete set in fair condition, having original covers neatly backed with red tape. Correspondence concerning price solicited, or first reasonable offer. S. D. Hicks, Entomology Research Institute, Room 1004, K. W. Neatby Bldg., Ottawa, Canada.

CICINDELIDAE: The following 3 papers are in preparation: "Cicindelidae of Quebec," "Food of cicindelids of the world," and "**Cicindela ancocisconensis** Harris." Label data, observations, and food habit notes would be appreciated. Andre Larochelle, College Bourget, C. P. 430, Rigaud, Quebec, Canada.

SCARABAEIDAE: Studying myrmecophilous and termitophilous Aphodiinae. Request loan of New World material especially. Will sort from general scarab collections or from light trap samples. Robert E. Woodruff, Fla. Dept. Agr., P. O. Box 1269, Gainesville, FL 32601.

HYDROPHILIDAE: Presently revising the genus **Hydrochus** from North, South, and Central America, including the Antilles. Request loan of any material from the Western Hemisphere. John L. Hellman, Ent. Dept., Univ. Maryland, College Park, MD 20742.

TENEBRIONIDAE: Building world-wide reference collection. Will purchase or exchange other Coleoptera. Especially desire immature stages. Kirby W. Brown, Peabody Museum, Yale Univ., New Haven, CT 06520.

HELODIDAE: Revising **Elodes**, need material from NW, W, SW, & S. Will pay postage. Prefer wet material, but mounted or dry OK. Desire larvae also. G. G. Kennen, 381 N. Central Ave., Ramsey, N.J. 07446.

CERAMBYCIDAE: Longicornes du Laos by Gressitt, Rondon, and Breuning. Pacific Insects Monograph 24, 1970, 651 p., 102 pl. (2 color), maps. Over 1000 species illustrated. $17.50 hard cover; $16.00 paper. Bishop Museum Press, Box 6037, Honolulu, HI 96818.

WORLD RESEARCH DIRECTORY: Richard L. Jacques and Dr. Ross H. Arnett, Jr. are preparing a world list of **current** research projects on Coleoptera. A volume will be published as a companion to the recently published "Directory of Coleoptera Collections." Anyone wishing to have a research project listed should write to R. L. Jacques, Dept. of Entomology, Purdue University, Lafayette, Indiana 47907. Forms will be provided.

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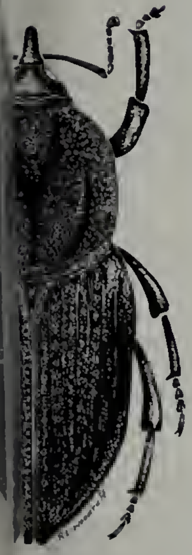

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THE COLEOPTERISTS BULLETIN

(FOUNDED 1947 BY ROSS H. ARNETT, JR.)

The **Coleopterists Bulletin** is published quarterly, beginning in March, by the Coleopterists Society. All manuscripts, editorial questions, or business matters should be sent to the editor: Dr. Robert E. Woodruff, Florida Department of Agriculture, P.O. Box 1269, Gainesville, Florida 32601.

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The **Coleopterists Newsletter** is a mimeographed publication issued twice a year and mailed to all members of the Coleopterists Society regardless of whether they have a subscription to the **Coleopterists Bulletin.** News items and correspondence concerning the **Newsletter** should be sent to the editor: Dr. C. W. O'Brien, Div. Entomology, Texas Tech Univ., Lubbock, TX 79409.

NOTICE TO AUTHORS

Manuscripts will be considered from any authors, although those from members of the Coleopterists Society will be given priority. It is suggested that all prospective authors join the Society. All manuscripts should conform to instructions in the **Style Manual for Biological Journals** (2nd Ed.) prepared by the Committee on Form and Style of the Conference of Biological Editors, and published by the American Institute of Biological Sciences, 2000 P Street NW, Washington, D. C. 20063.

The following exceptions are noted: 1) All geographical names are to be spelled out, 2) use words, not symbols, for male and female, 3) use numerals throughout, except to begin a sentence, 4) entomology, -ical, -ist, etc. are to be abbreviated Ent. in literature citations.

Specimen label data should be listed in the following manner: MEXICO: State of Veracruz, Fortin de las Flores, 10-VIII-70, I. B. Jones, under bark of **Pinus moctezumae**, 7000ft. [USNM] (2). The number in parentheses indicates the number of specimens. Geographical names are listed in order with largest units first, with states, departments, provinces, parishes, and/

Continued inside back cover

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A SYNOPSIS OF THE SPECIES OF *ASIDINA* IN THE UNITED STATES WITH DESCRIPTION OF A NEW SPECIES FROM ARIZONA (COLEOPTERA: TENEBRIONIDAE)

Charles A. Triplehorn and Kirby W. Brown

The Ohio State University, Columbus, Ohio 43210 and Peabody Museum of Natural History, New Haven, Connecticut, 06520

Abstract

The geographical variation, ecology, and distribution are discussed for the 6 species of *Asidina* known to inhabit the U. S. A key is presented for separation of the species, and *Asidina rugicollis* NEW SPECIES is described from Arizona. *Asidina teres* Casey, *A. liberta* Casey, and *A. parallela terricola* Blaisdell are all reduced to synonymy.

The genus *Asidina* was established by Casey (1912) to receive 4 known species and 2 new ones. He designated *A. parallela* (LeConte) as type, included *A. wickhami* (Horn), *A. furcata* (Champion), and *A. confluens* (LeConte), and described *A. teres* and *A. liberta.* Since then there have been few additions to the genus. Blaisdell (1923) described a new subspecies, *A. parallela terricola,* and Brown (1971) transferred *semilaevis* (Horn) from *Pelecyphorus* to *Asidina.*

The genus *Asidina* was poorly characterized by Casey, and the following emended diagnosis is offered for clarification: Mentum large, broad, separated from mandibles by a wide space exposing cardo, but closely approaching sides of buccal opening. Postgenal process short, blunt to pointed, reaching no farther than midline of mentum. Gular pedestal prominent and long, junction with mentum distinctly concave, width about two-thirds that of mentum. Ligula prominent and notched, often tumid and overlapping mentum. Apical segment of maxillary palpus enlarged, recti-triangular to acute basally in the male (Fig. 7A), generally smaller and obtuse in the female (Fig. 7B). Eyes oval to elongate oval, often weakly emarginate. Antennae slender, tenth segment enlarged and bearing a distinct spongiose area on each side of the apex, eleventh segment reduced in size and spongiose apically. Tarsi with short, spiniform hairs beneath. Anterior tibia smooth to weakly serrulate on outer surface, dorsal apical angle blunt to acute and moderately everted. Prosternal process gradually declivous behind coxa, never sharply margined. Body parallel to narrowly sub-oval, often flattened on dorsal surface, glabrous to clothed with short simple setae but never prominently hirsute. Posterior angles of pronotum inconspicuous, generally blunt, occasionally acute, rarely slightly overlapping elytra. Width of elytra at humeri sub-equal to width of pronotum at posterior angles. Elytra always with distinct, relatively smooth carinae forming the lateral borders, carinae sometimes bifurcate. Discal carinae present or absent.

Casey's original diagnosis of *Asidina* was based on only 6 specimens. This was far too small a sample to give him a good idea of the variability in the genus. Therefore some of his comments are not wholly accurate. Phylogenetically this genus is probably most closely related to the genera

Trichiasida, Poliorcetes, and *Stethasida.* Species of *Trichiasida* are generally more hirsute, have a convex pronotal base, and usually lack carinae on the elytra. *T. impotens* Casey and *ignava* Casey approach *Asidina* in form of pronotum and in having weak elytral carinae, but with an incomplete lateral margin which is not as sharp. *T. horrida* (Champion) and *T. impetrata* (Horn) have distinct, but coarse and tuberculate, carinae on the elytra, are evidently hirsute, and have the transverse mentum more typical of *Trichiasida.* The separation between *Trichiasida* and *Asidina* is not clearly defined. The rare *Poliorcetes* from southern Mexico is distinguished by the prosternal process forming a prominent, thick, unmargined lobe behind the coxae. *Stethasida* is also best distinguished by the prosternal process which forms a sharply margined, prominent and broad lobe behind the coxae. *Parasida, Notiasida,* and the *Asidopsis opaca* group superficially resemble *Asidina* but are easily distinguished by the prominent, acute, posterior angles of the pronotum which usually project back over the elytra.

KEY TO SPECIES OF *Asidina*

1. Surface of elytra with scattered granules or tubercles, and with small but visible setae; base of pronotum bisinuate; lateral margins of pronotum thin; length: 10.5 to 18.7 mm 2

1′. Surface of elytra smooth and glabrous; base of pronotum arcuate, truncate or trisinuate; lateral margins of pronotum thick; length: 18.5 to 26.0 mm 5

2(1). Disk of pronotum coarsely and densely punctured, the punctures separated by a distance subequal to their diameter or less medially, becoming larger, deeper and confluent laterally; elytra convex between marginal carinae (Fig. 1) .... *rugicollis* *NEW SPECIES*

2′. Disk of pronotum finely to minutely punctured, with ony a few strong and widely separated punctures sometimes present inside reflexed lateral margins; elytra flattened between marginal carinae 3

3(2′). Discal carina attaining elytral base or nearly so and well separated from marginal carina throughout its length; marginal carina bifurcate at least one-third the distance from base (inner branch sometimes obsolete or reduced to a row of tubercles) 4

3′. Discal carina not attaining base of elytra, ending at least one-sixth of the elytral length from base, closely parallel to marginal carina; marginal carina never bifurcate (Fig. 2) .... *parallela* (LeConte)

4(3). Dorsum practically glabrous with only minute decumbent setae visible at high magnification; lateral margins of pronotum broadly rounded; pronotum strikingly gibbose in lateral view (Fig. 3) .... *furcata* (Champion)

4′. Dorsum densely clothed with fine, stiff, erect setae; lateral margins of pronotum feebly rounded; pronotum weakly gibbose in lateral view (Fig. 4) .... *wickhami* (Horn)

5(1′). Each elytron with 2 carinae, a marginal one and a divergent discal one which usually joins the marginal near elytral base (Fig. 5) .... *confluens* (LeConte)

5′. Each elytron with 4 carinae, a marginal one, an outer discal one which joins the marginal behind elytral base, and 2 independent parallel inner discal carinae (Fig. 6) .... *semilaevis* (Horn)

In studying specimens for this review we encountered a series of specimens from northern Arizona which appeared distinct from any known species of *Asidina*. Careful study convinced us that this was a new species, allied to *A. parallela*.

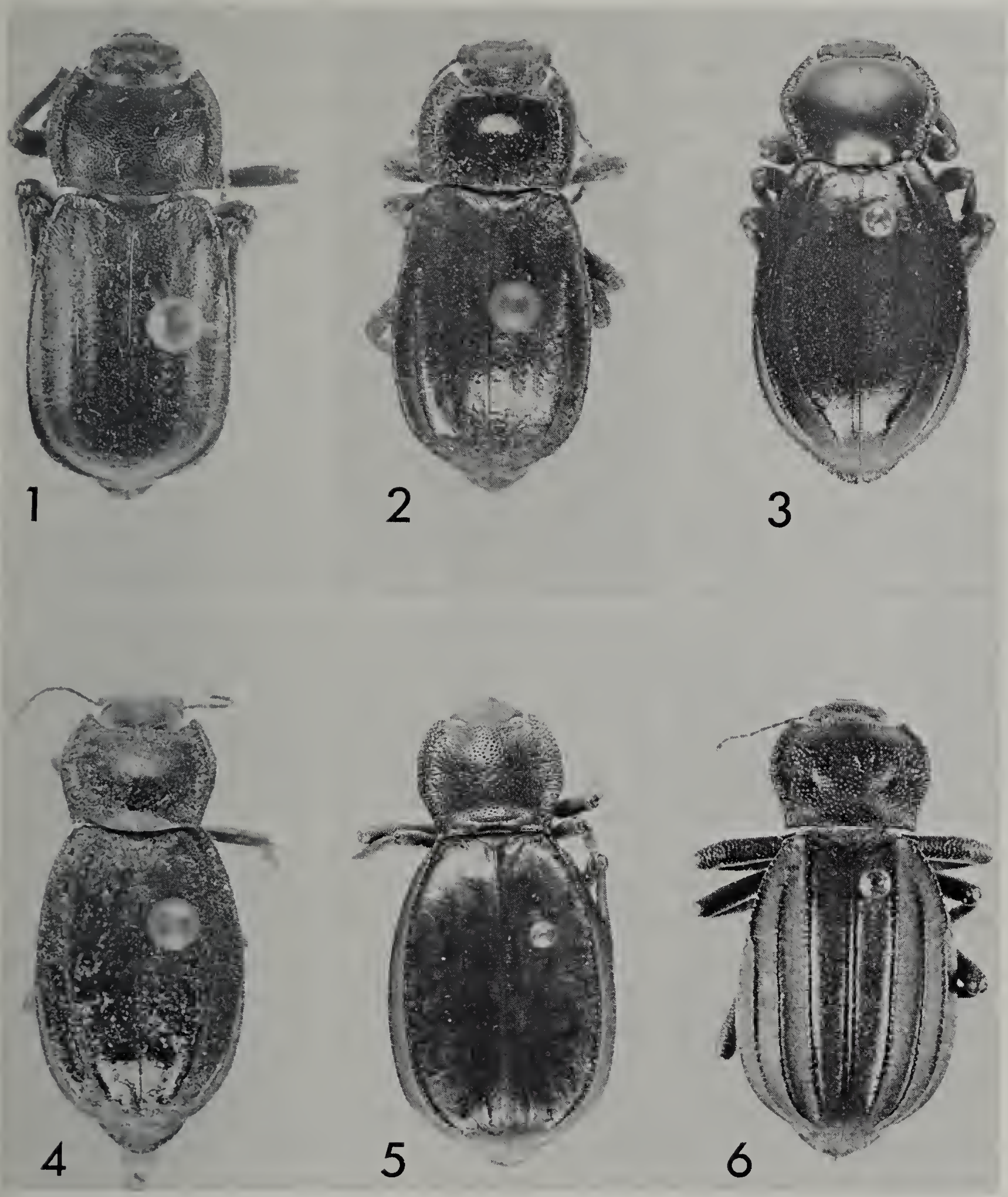

Fig. 1-6. *United States Species of Asidina*: 1. *A. rugicollis* ♂ Paratype, S. Rim, Grand Canyon, Arizona, 19-VII-68, C.A., W.E., & B. W. Triplehorn. Actual Length: 13.6 mm. 2. *A. parallela* ♀, Maricopa Co., Ariz., S. Mt. Pk. 10-X-65, S. C. Williams. Actual length: 14.6mm. 3. *A. furcata* ♀, Big Bend Nat. Pk., Texas, Santa Elena Canyon, 3-IX-68, J. A. Brubaker and F. J. Moore. Actual length: 19.5mm. 4. *A. wickhami* ♀, Maricopa Co., Ariz., S. Mt. Pk., 12-IX-65, S. C. Williams. Actual length: 15.3 mm. 5. *A. confluens* ♀, Borego, San Diego Co., Calif., 4-8-50, W. F. Barr. Actual length: 26.4 mm. 6. *A. semilaevis* ♂, Scottsdale, Ariz., 30-IX-66, P. Pinter. Actual length: 23.1 mm.

Asidina rugicollis Triplehorn & Brown, NEW SPECIES.
(Fig. 1, 7)

HOLOTYPE, MALE: oblong, dark purplish-black, inconspicuously setose, surface dully shining. HEAD coarsely and confluently punctured, transversely impressed near epistoma. Eyes weakly emarginate anteriorly. Antennae slender, sparsely clothed with stiff, golden-orange setae. Apical segment of maxillary palpi rectitriangular, distal edge more than one-fourth longer than proximal edge (Fig. 7A).

PRONOTUM subquadrate, convex, lateral margins moderately reflexed, uniformly arcuate viewed from above, widest at middle; disk uniformly, coarsely and densely punctured, the punctures separated by a distance subequal to their diameter, each puncture bearing a short, thick, golden-orange seta; punctures laterally becoming larger, deeper, and confluent, becoming rugose and irregular inside reflexed area; acies wrinkled, studded with numerous short, thick setae; apical angles acute and weakly everted; basal angles obtuse; base weakly bisinuate; ventral surface uniformly coarsely and confluently punctured.

ELYTRA: elongate oval, widest slightly anterior to middle, subparallel about one-fourth of length, declivous in posterior one-fourth, convex between lateral carinae; base slightly narrower than width of pronotum at basal angles; scutellum equilateral; disk and sides sprinkled with small granules, each bearing a short, golden-orange seta; each elytron with a strong lateral carina, almost, but not quite attaining the apex; outer discal carina not sharply defined, joining lateral carina at the basal one fourth, diverging gradually from lateral carina, becoming weaker posteriorly and disappearing about half way down the apical declivity, a row of closely-spaced tubercles (slightly larger than discal ones) along the crest; middle and inner discal carinae both visible, parallel to suture, but very weak, shallowly and broadly convex; suture flat on disk, becoming slightly elevated on declivity toward apex; epipleura narrow, epipleural fold weakly convex on anterior three-fourths, becoming sharply carinate on apical fourth.

LEGS, especially tibiae, with stiff golden setae; femora rugose; tibiae tuberculato-rugose; dorsal apical angle of protibiae moderately everted and acutely spiniform. Prosternal process moderately concave between coxae, smoothly declivous behind, with thin lobe barely contacting mesosternum.

ABDOMEN: asperate, each asperity bearing a thin, decumbent golden seta. Length: 11.4mm; width of pronotum: 4.2mm; width of elytra: 5.1mm.

ALLOTYPE, FEMALE: Similar to holotype. Body larger. Apical segment of maxillary palpi rectitriangular, distal edge less than one sixth longer than proximal edge (Fig. 7B). Elytra slightly more convex between lateral carinae; discal carinae more evident, the outer particularly more pronounced. Length: 14.2mm; width of pronotum: 5.0mm; width of elytra: 6.4mm.

HOLOTYPE AND ALLOTYPE: U. S. A., ARIZONA, COCONINO CO., Grand Canyon National Park, South Rim, 19-VII-68, W. E., C. A., and B. W. Triplehorn [Ohio State University Collection of Insects and Spiders]. PARATYPES: 33 specimens, all from ARIZONA: Coconino Co.: same data as holotype, 3 males, 2 females [OSUC]; 3 males, 3 females [KWBC]; 1 male, 1 female [USNM]; Grand Canyon, 26-27-VII-26, E. C. Van Dyke, 3 males, 5 females, [CASC]; 1 male, 1 female [ASUT]; 1 male, 1 female[BMNH]; 1 male, 1 female [MHNP]; Flagstaff, 1-VIII-33, K. Maehler, 1 male [CISC]; Flagstaff, 30-VII-38, D. J. & J. N. Knull, 1 male [OSUC]; Flagstaff, 29-VII-54, H. E. Cott, 1 male [UCDC]; northwest slope of Kaibab Plateau, 3-IX-26, 6700′, R. & H., 1 female [ANSP]. Navajo Co.: Kayenta, 27-VII-33, K. Maehler, 1 male [CISC]. Yavapai Co.: Prescott, 13-VIII-37, H. M. Harris, 1 male [ISUI].

REMARKS: This species appears to be closely related to *Asidina parallela* (LeConte). It is distinguished from it by the coarsely punctate pronotum, acute and slightly everted apical angles of pronotum, convex elytra, weak outer discal carina which joins lateral carina toward elytral base, more visible middle and inner discal carinae, and smaller average size.

Geographically the known range of *A. rugicollis* is limited to northern Arizona. It is isolated from *A. parallela* except for one very old specimen of *parallela* labeled "Gd. Canyon, Ari., May". It overlaps *A. wickhami* in the southern part of its range but is easily distinguished from it by the coarsely punctate and much flatter pronotum, smaller size, and greater convexity of the elytral disc between marginal carinae.

It also superficially resembles the *Stethasida muricatula* group and *Trichiasida impotens* Casey. However close examination will quickly reveal the generic differences.

There is some variation among the specimens of *A. rugicollis* on hand. The lateral margins of the pronotum are sometimes so weakly reflexed as to appear almost flat. Overall the margins are less reflexed than in *parallela.* The strength of the discal carinae is variable. They are always weak, and the outer discal carina is sometimes almost obsolete and indicated only by tubercles. The surface luster of the elytra varies from frosty to completely dull.

Gross measurements of the specimens vary within a fairly narrow range. Although males and females appear similar superficially, sexual dimorphism is clearly evident in the measurements. The females are larger, relatively broader, and with a slightly larger ratio of elytral width to thoracic width (Table 1). The sexual dimorphism of the maxillary palpi is also not very obvious upon visual examination, but a graph of measurements shows complete separation between the sexes (Fig. 7C). This dimorphism is similar in magnitude to the other species of *Asidina.*

TABLE 1. SELECTED MEASUREMENTS OF *Asidina rugicollis* (MEANS AND RANGES).

Measurement	*Males*, $n = 18$	*Females*, $n = 15$
Total length	11.9mm (11.1–13.0)	13.2mm (11.5–14.5)
Thorax width	4.3mm (3.9–4.8)	5.0mm (4.4–5.3)
Elytra width	5.3mm (4.5–5.8	6.4mm (5.7–6.9)
$\frac{\text{Elytral length}}{\text{Elytral width}}$	2.3	2.1
$\frac{\text{Elytral width}}{\text{Thoracic width}}$	1.2	1.3

Asidina parallela (LeConte 1851: 128)
(Fig. 2)

From November, 1964 to December, 1965, Stanley C. Williams conducted ecological studies utilizing pitfall traps in South Mountain Park, near Phoenix, Arizona. In the process of identifying the Tenebrionidae, Triplehorn determined 1,513 specimens as *Asidina teres* Casey, 54 as *A. liberta* Casey, and 4 as *A. wickhami* (Horn), but with reservations regarding the status of Casey's species. Until this time we had considered all species of *Asidina* as rare and, indeed, they remain so in most collections. Preliminary determinations were made using Casey's 1912 revision as the primary reference.

Recently Triplehorn (July, 1969) and Brown (December, 1967) had the opportunity to study the Casey types of *A. teres* (USNM #46535) and *A. liberta* (USNM #46534), LeConte's types of *A. parallela* (MCZ #4535) and *A. confluens* (MCZ #4534), and Horn's types of *A. wickhami* (ANSP #3932) and *A. semilaevis* (ANSP #3931). With only 6 specimens when he described *Asidina* and the 2 new species, Casey had no notion of the variation which occurs in any of the species. The suspicions we both held regarding the status of Casey's species were confirmed.

We are placing *Asidina teres* Casey as a synonym of *A. parallela* (LeConte). Casey's unique type labelled "Ari." is narrower, shorter, and shinier and has less evident setae than LeConte's unique type specimen. However these differences fall well within the range of variation observed in the large series from South Mountain Park.

The variability in surface luster of *A. parallela* is rather striking. Some specimens are quite dull and often coated with dust and dirt, while others appear highly polished. Closer examination of Arizona specimens revealed that the dull appearance is caused by a waxy layer to which dirt adheres. This layer can be rubbed off, revealing a shiny surface. However most California specimens are not shiny but show a frosty, minutely rugulose surface, and weak granules on the pronotum rather than minute punctae. Too few specimens from California are available to determine the consistency of these differences, and we believe it is best to consider *A. teres* (type from Arizona) as a synonym of *A. parallela* (type from California).

Gebien (1910) proposed *neglecta* as a new name to replace *parallela*. At that time the species now in *Asidina* were in the genus *Asida* Latreille. Solier (1836) had described an *Asida parallela* from Spain. Therefore *Asida parallela* (LeConte) was a junior homonym and Gebien rightly chose a new name. By the time Gebien prepared his new catalogue (1937), Casey (1912) had broken the North American components of *Asida* into a number of new genera, and had placed *parallela* (LeConte) into his new genus *Asidina*. Therefore the homonymy no longer existed, and Gebien himself placed *neglecta* into synonymy with *parallela* (LeConte).

Blaisdell (1923: 254) described a new "variety" of *parallela* from Guaymas, Sonora, Mexico, under the name *terricola*. Since he listed it as a trinomial, the International Rules provide that it must be considered a subspecies until determined otherwise. We have on hand 3 specimens of *Asidina parallela* recently collected in Guaymas which fit within the variation range of *parallela*. Although they do not precisely fit Blaisdell's description, we do not believe that *terricola* can be recognized as a distinct entity and hereby synonymize it under *parallela* (LeC.). An additional specimen mentioned by Blaisdell (1923) from Santa Inez Island is rather distinct from anything we consider *A. parallela*, and it is probably an undescribed species.

Other than the enormous series from South Mountain Park, records for *parallela* are scarce. We have seen 55 specimens from the following localities: ARIZONA: Cochise Co.: Benson. Coconino Co.: Grand Canyon. Greenlee Co.: no locality specified. Maricopa Co.: Lake Pleasant; Mesa; Paradise Valley; Phoenix; Scottsdale; Tempe. Pima Co.: Agua Dulce Mts.; Covered Wells, Organ Pipe National Monument; Quitobaquito; Tucson. Pinal Co.: Apache Junction; 25 mi. SSE Casa Grande; Sierra Estrella. County not known: Beeline, Rolito, Usery Pass. CALIFORNIA: Riverside Co.: Palm Canyon near Palm Springs. San Diego Co.: Mason Valley; Palm Canyon in Borrego State Park; Scissors Crossing; Sentenac Canyon. MEXICO: Sonora: Bahia Kino; Guaymas. Measurements: length: 10.5-16.2mm; width: 4.4-7.4mm.

The only specimens from Mexico considered to be *parallela* are those from Sonora State (Bahia Kino and Guaymas). Several other specimens are on hand from Baja California and islands in the Gulf of California, including ones reported by Blaisdell (1923:253) from Isla Partida which resemble *parallela*, but show a striking amount of divergence from that species. Specimens from different islands even show recognizable divergence from each other. In addition we have studied specimens which clearly cannot be attributed to any known species of *Asidina*. Since at present we cannot satisfactorily establish the identity of specimens from this region, we must exclude them from our discussion.

Asidina wickhami (Horn 1894:499)

(Fig. 4, 8)

Casey's unique type specimen of *Asidina liberta* (Tempe Desert, Arizona) has the marginal carina of the elytra dividing well behind the first abdominal suture but not as far back as the second (at about 2/3 the length of the elytra) while Horn's type (Riverside, Arizona) of *wickhami* has the carina dividing opposite the first abdominal suture (at slightly more than ½ the length of the elytra). The pronotum of the *liberta* type is more convex from front to back, and the dorsal surfaces of the pronotum and elytra bear fewer and more inconspicuous setae resulting in a more shiny appearance. Also the sides of the body are narrower and more parallel than in Horn's type of *wickhami*.

All of these differences disappear when a large series is studied. The point where the marginal elytral carina divides is particularly variable and this is why both *wickhami* and *liberta* were originally recognized by Triplehorn in the South Mountain Park series. There appears to be an overall shift in position of the bifurcation in specimens from southern to northern parts of the range. The point of bifurcation tends to be closer to the first abdominal suture in southern specimens (Fig. 8D, E) shifting toward the second abdominal suture in the northern part of the range (Fig. 8B, C). The distinctness of the inner branch is also quite variable. The extreme is reached by some specimens from the Hualapai Mountains, Valentine, Kingman, Peach Springs and Williams areas where the inner branch totally disappears (Fig. 8A). These aberrant specimens cannot be confused with *parallela* which is characterized by an unforked marginal costa, as the inner (discal) costa almost attains the elytral base and turns sharply inward, while the discal costa in *parallela* does not come near the elytral base and turns slightly outward. *Asidina liberta* Casey is without question a synonym of *A. wickhami* (Horn).

Records for *wickhami* are equally as scarce as for *parallela*. In addition to the 58 from South Mountain Park, we can report it from the following localities, all in ARIZONA (62 specimens): Coconino Co.: Bill Williams Fork. Gila Co.: Payson; Pinal Mts.; Riverside. Maricopa Co.: Mesa; Phoenix; Sunflower; Tempe; Wickenburg. Mohave Co.: Hualapai Mts.; Kingman; Peach Springs; Valentine. Pima Co.: Sabino Canyon; Santa Catalina Mts.; Tucson; Tucson Mts. Pinal Co.: Sacaton. Yavapai Co.: Mayer. Measurements: length: 11.6-16.5mm; width: 5.1-7.4mm.

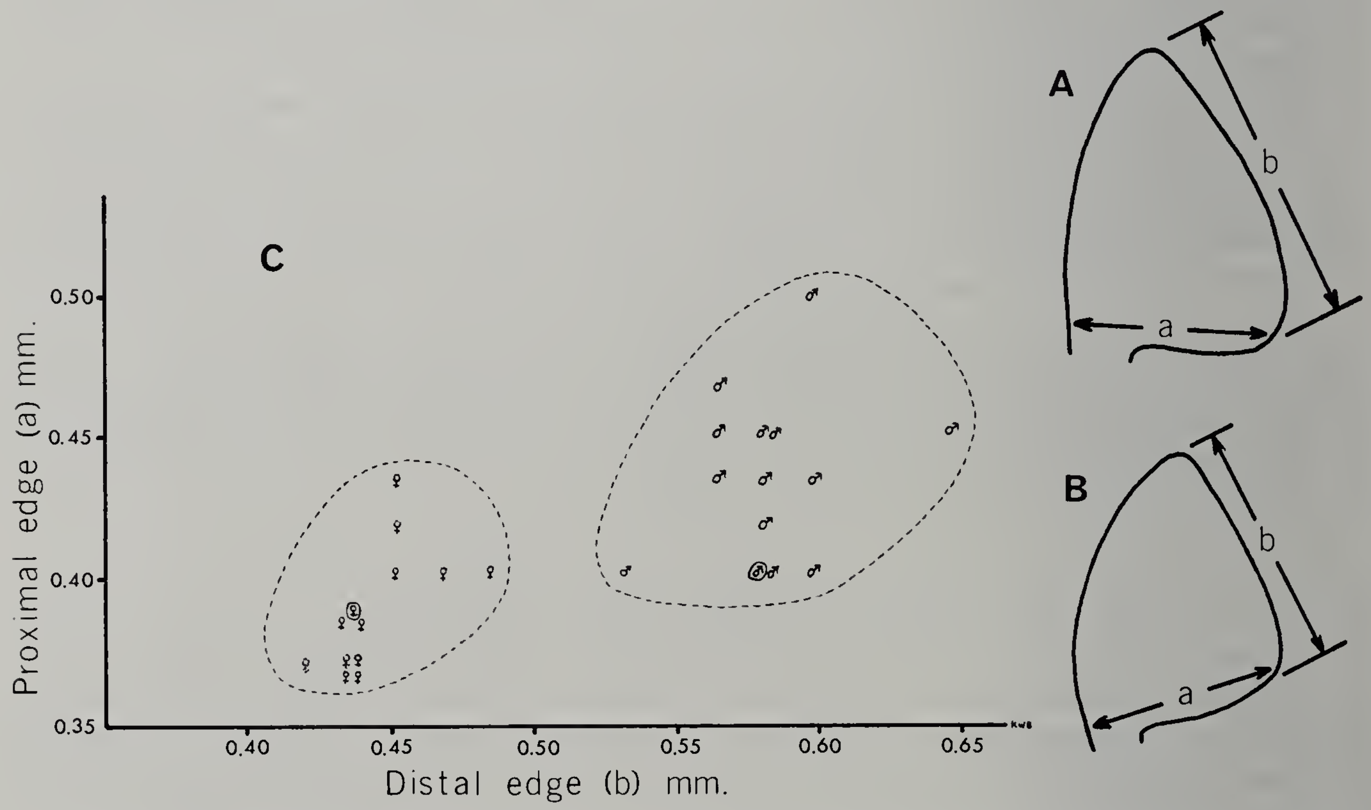

Fig. 7: *Asidina rugicollis* n. sp. A. Apical segment of maxillary palpus of holotype male; B. Same, allotype female; C. Graph of measurements of maxillary palpi of 14 males and 13 females (holotype and allotype circled).

At South Mountain Park, *A. parallela* was taken from September to May and was especially abundant in November and December. Records from other localities show the same pattern. *A. wickhami*, on the other hand, was taken from July to November, and was more abundant in July and August. Records from other localities begin in June, with most specimens being collected in August. *A. rugicollis* records include only late July and early August.

Asidina furcata (Champion 1892:499)
(Fig. 3, 9)

Champion (1892) described *Asida furcata* from a single specimen taken at Villa Lerdo in Durango, Mexico. Casey (1912:172) assigned this species to his genus *Asidina* although it is doubtful that he ever saw a specimen. Probably he inferred the relationship from Champion's very lucid description and excellent illustration (Champion 1892: plate 22, Fig. 15). Pallister (1954:26) reported 2 specimens collected in Coahuila State,

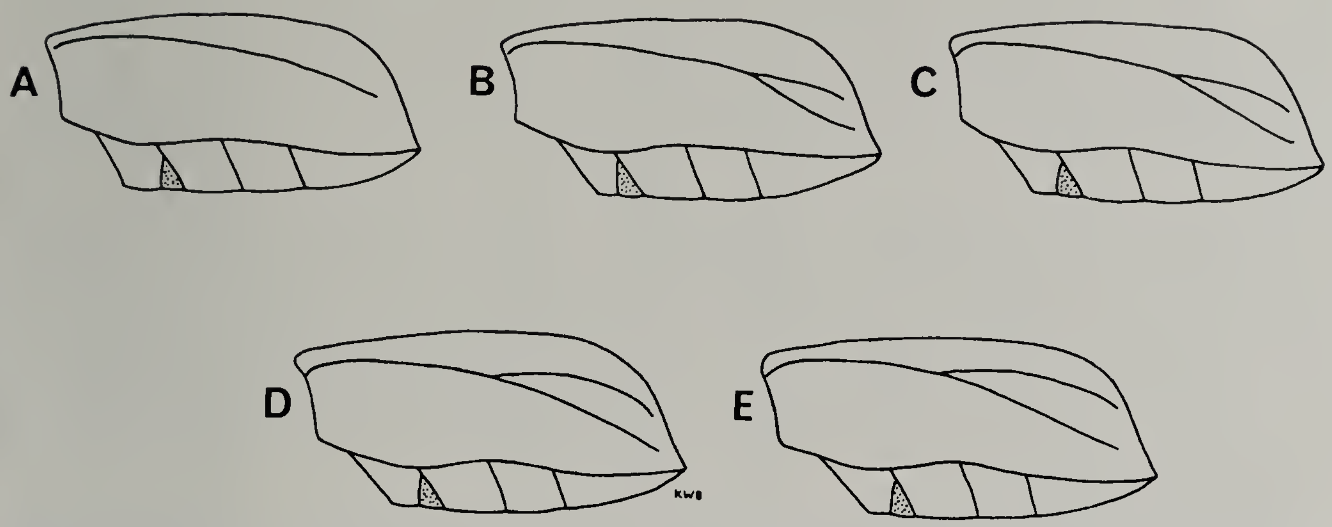

Fig. 8: *Asidina wickhami* (Horn), lateral view of elytra showing variation in bifurcation of marginal carina. ARIZONA: A. Valentine; B. Hualapai Mts. near Kingman; C. Tempe (Type of *A. liberta*); D. Riverside, Pinal Mts. (Type of *A. wickhami*); E. Pinal Mts.

Mexico by the Rockefeller Expedition; one from Cabos, and the other from 5 miles north of Saltillo. Both are within 200 miles of the type locality.

Frank J. Moore and John A. Brubaker collected 7 specimens of a species of *Asidina* unknown to us, but which fitted Champion's description of *A. furcata* perfectly. They were found on the rock walls of Santa Elena Canyon, Big Bend National Park, Brewster County, Texas, on 13 September, 1968 at night.. Richard L. Berry and Frank J. Moore collected 2 more in the same location on 4 May, 1969. In gleaning through collections we discovered an additional 40 specimens which appeared to be *A. furcata;* 38 from Texas and 2 from Mexico.

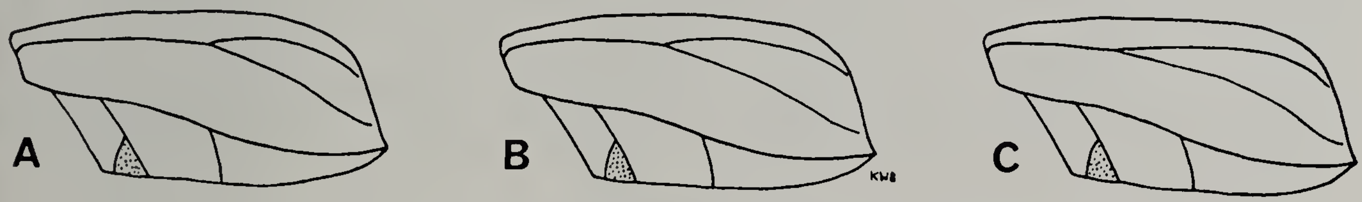

Fig. 9: *Asidina furcata* (Champion), lateral view of elytra showing variation in bifurcation of marginal carina. A. Saltillo, Mexico and Big Bend, Texas; B. Big Bend, Texas: C. Villa Lerdo, Durango, Mexico (Type).

Since *A. furcata* is unrecorded from the United States, and we had not seen reliably determined specimens, we submitted specimens for comparison with the type in the British Museum (Natural History). Our tentative identification was confirmed by C. M. F. von Hayek who informed us that the type is evidently immature, but that our specimens appeared to agree with it except in regard to the bifurcation of the marginal carina of the elytra. This established Casey's placement of *A. furcata* in *Asidina* as correct. Brown examined the Rockefeller specimens and confirmed the accuracy of Pallister's determinations.

In the type specimen of *A. furcata* the marginal carina divides just posterior to the hind coxal cavities as viewed laterally (Fig. 9C). In 6 of the specimens from Big Bend, the marginal carina divides opposite the first abdominal suture behind the hind coxal cavities (Fig. 9A). A similar bifurcation occurs in 2 specimens seen from the Saltillo area in Mexico. In the other Big Bend specimens, Cochran Ranch specimen, and Edinburg specimen, the bifurcation is intermediate in position (Fig. 9B). In the 30 remaining specimens from Texas, and 1 from near Torreon, Mexico, the bifurcation occurs just behind the hind coxal cavities as in the type specimen.

There is also variation in sculpture. The specimens from Big Bend, Edinburg, and Saltillo are smoother with smaller and sparser microtubercles on the elytra, and the pronotum is more finely and sparsely punctured than the other specimens studied. This variation closely follows the pattern of bifurcation of the marginal costa. These appear to be cases of localized geographic variation, and we feel that all the specimens studied are conspecific with the type.

Seven of the Big Bend specimens mentioned above are deposited in [OSUC]; the other 2 are in the personal collection of R. L. Berry. We can also report the following records for the species, a total of 40 specimens. All are single specimens unless otherwise indicated: TEXAS: Terrell Co.: 16 mi. N of Dryden, Route 349, 2-VII-59, George E. Ball family; Cochran Ranch, Sanderson, 2-VII-59, George E. Ball family [UASM]. Brewster Co.: 74 mi. SE of Marathon, 20-VI-66, J. S. Buckett, M. R. and R. C. Gardner [UCDC]; Big Bend Nat. Park, Boquillas Cn., 28-30-VII-55, E. G. Matthews [CUIC]; Big Bend Nat. Park, Boquillas, 1850′, 17-24-V-59, Howden and Becker (3); Big Bend Nat. Park, 5 mi. N of Glenn Springs, 3000’, 24-V-59, Howden and Becker [CNCI]. Val Verde Co.: Pecos River Bridge on U.S. 90, 8-X-58, H. V. Weems, Jr. [FSCA]; same locality, 2-IX-68, F. J. Moore & J. A. Brubaker [OSUC]; Comstock, 26-V-52, M. Cazier, W. Gertsch, R. Schrammel (21) [AMNH]; Del Rio. 25-26-IV-59, Becker and Howden [CNCI]; Langtry, 19-III-60, W. Gertsch and R. Schrammel (2); Shumla, 26-V-52, M. Cazier, W. Gertsch and R. Schrammel (2) [AMNH]. Upton Co.: McCamey, 4-VIII-31, H. M. Smith [KSUC]. Hidalgo Co.: Edinburg, S. Mulaik [AMNH]. MEXICO: Coahuila State: 19 mi. W of Saltillo, 27-29-VIII-46, C. M. Bogert [AMNH]. Durango State: 40 mi. S of Torreon, 18-VII-61, D. H. Jansen [CISC]. Measurements (all 49 specimens): length: 13.5-18.7mm; width: 6.4-9.5mm.

Asidina confluens (LeConte 1851:128)

(Fig. 5, 10)

Casey (1912:172) confessed that he was unfamiliar with the species described by LeConte as *Pelecyphorus confluens* and somewhat reluctantly assigned it to *Asidina*, pointing out the aberrant size and sculpture. This species is larger, with smoother elytra but more coarsely punctate pronotum than the other species known to Casey. Other characters not typical of the previously discussed species of *Asidina* are the arcuate to truncate rather than bisinuate thoracic base, the thick thoracic margins, and the almost complete lack of setae on the dorsal surface. However it conforms reasonably well in such characters as form of the mentum, ligula, maxillary palpi, pro-tibiae, and arrangement of carinae. Under the present concept of *Asidina*, it seems that *A. confluens* was correctly placed in that genus by Casey.

Although not abundant, the species is found throughout the Mohave desert of California, spreading into Mexico and Arizona. Its preferred habitat seems to be sand dunes, and the beetles can be found wandering about at dusk when the temperature has fallen. Collecting dates range from August to April, but specimens collected from January to April appear to have been already dead when found. Peak occurrence is from September

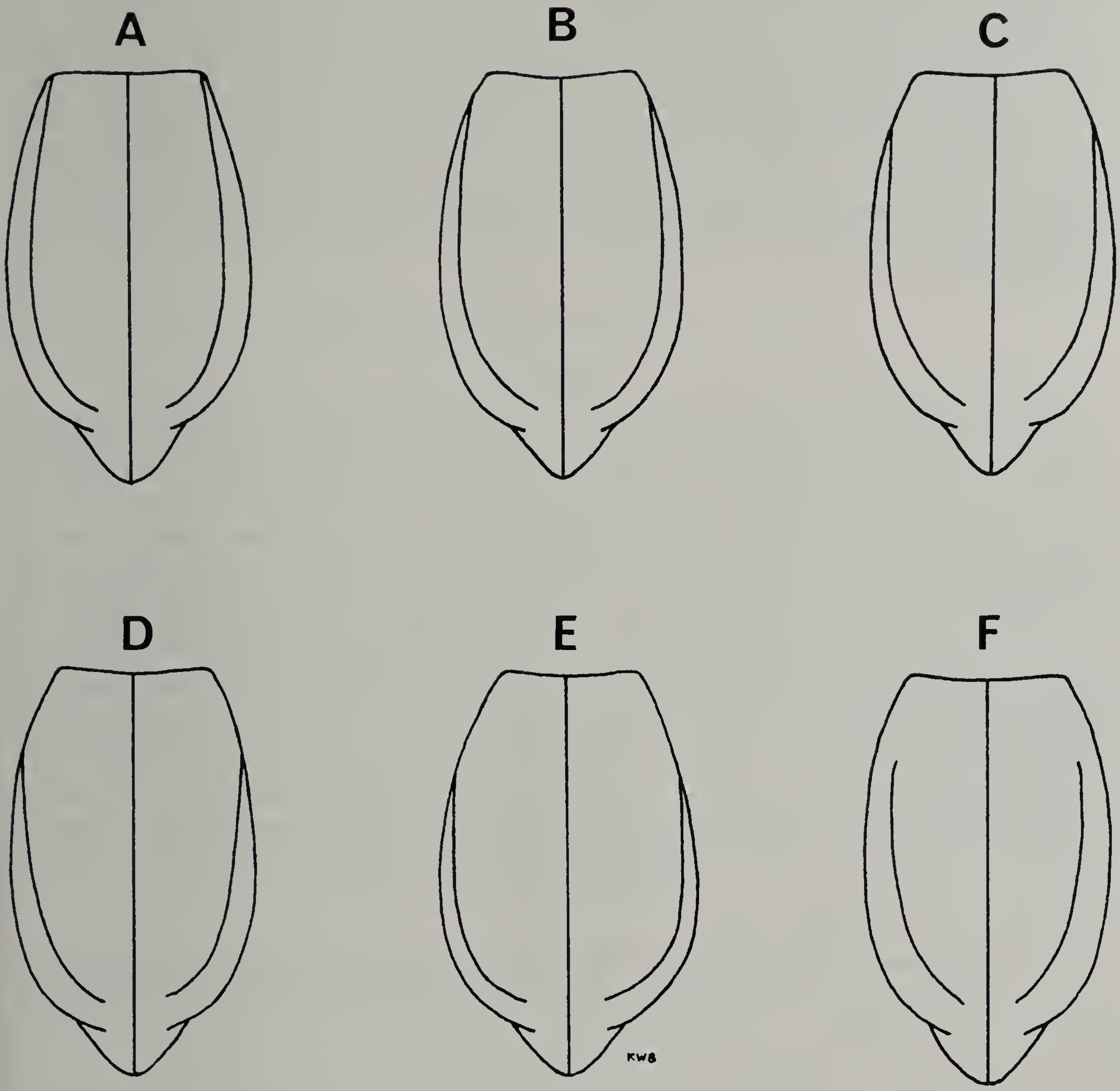

Fig. 10: *Asidina confluens* (LeConte), dorsal view of elytra showing variation in junction of discal carina with marginal carina. A. Twenty-nine Palms, California; B. Blythe, California; C. Borrego Springs, California (similar to type); D. Patagonia, Arizona; E. Puerto Peñasco, Sonora, Mexico; F. Desemboque, Sonora, Mexico.

to November. Superficially *A. confluens* resembles *Philolithus carinatus* (LeConte) with which its range overlaps, but in fact they belong in rather distinct branches of the tribe Asidini.

A. confluens shows a high degree of variability in expression of the inner elytral carina. In the California specimens this inner carina tends to join the marginal carina at or near the elytral base (Fig. 10A,B,C). In Arizona specimens the junction is farther back, almost in line with the hind coxae (Fig. 10D). Baja California specimens are intermediate, while some from Sonora are extreme with the junction behind the hind coxae (Fig. 10E), or the inner carina not joining the marginal carina at all (Fig. 10F). This variability seems equivalent to that reported in *A. furcata* and *A. wickhami.*

We can report the following records for this species (129 specimens): ARIZONA; Maricopa Co.: Gila Bend; Phoenix. Pima Co.: Ajo; 21 mi. N of Quijota; Tucson. Santa Cruz Co.: Patagonia. CALIFORNIA: Imperial Co.: Bard; Coyote Wells; El Centro; Glamis; 8 mi. N of Glamis; Holtville; SE of Niland; Palo Verde. Riverside Co.: Blythe; 18 mi. W. of Blythe; 25 mi. W of Blythe; Cathedral City; Hopkins Well; Indio; Palm Springs, 18 mi. S of Palm Springs; Thermal; 4 mi. E of Thousand Palms. San Bernardino Co.: Cronise Valley Dunes; Dale Dry Lake; Kelso Dunes; Needles, Twentynine Palms; 6 mi. E of Twentynine Palms. MEXICO: Baja California: 3 mi. S of San Felipe; 20 mi. S of San Palano. Sonora: Cholla Bay; Desemboque; Estero de Sargente; Puerto Peñasco; 55 mi. W. of Sonoyta.

Asidina semilaevis (Horn 1870:284)
(Fig. 6)

This species, recently transferred from *Pelecyphorus* to *Asidina* (Brown 1971), is about the same size and similar in appearance to *A. confluens*. *A. semilaevis* differs in having 2 additional carinae on each elytron, and a differently shaped pronotum with a weakly tri-sinuate base. The arrangement of discal carinae is similar to *A. rugicollis* n. sp. *A. confluens* and *semilaevis* form an aberrant branch of the genus *Asidina*. In looking at their morphology and geographical distribution, one is led to the speculation that they derived from a common ancestral species which became split geographically into 2 groups which evolved after isolation into *confluens* centered in the Mohave Desert of California, and *semilaevis* centered in southern Nevada. Hundreds of specimens have been collected in the region of Rock Valley near Mercury, Nevada at the Nuclear Test Site in intensive ecological studies (Tanner and Packham, 1962, 1965). Outside this area, records are exceedingly rare.

We can report only 12 specimens. All are single records unless otherwise noted: ARIZONA: Coconino Co.: Bill Williams Fork, VIII (2) [SEMC]; Flagstaff, 30-IX-53, B. Malkin [FMNH]. Maricopa Co.: Scottsdale, 30-IX-66, P. Pinter [ASUT]. Pima Co.: Tortilla Mts., 12 mi. N Tucson, VII-66 [W. Rosenberg]. Yavapai Co.: Congress Junction, VII [SEMC]. Yuma Co.: Alamo Crossing, IX [UAIC]; Kofa Mts., X [LACM]. CALIFORNIA: Riverside Co.: Blythe, VIII [CUIC]. NEVADA: Clark Co.: Las Vegas, IX [CUIC]; 3 mi. S Las Vegas, 1-IX-64, C. D. Johnson [NAUF]. Nye Co.: 2.9 mi. NW Lathrop Wells, 2650', 3-IX-65, K. W. Brown [KWBC].

CHECK LIST OF THE GENUS *Asidina* CASEY

Asidina parallela (LeConte 1851:128). Type Species. California, Arizona, Mexico.
=*neglecta* (Gebien 1910:134)
=*teres* Casey, 1912:171 NEW SYNONYMY
=*terricola* Blaisdell, 1923:254 NEW SYNONYMY
Asidina rugicollis Triplehorn & Brown NEW SPECIES. Arizona.
Asidina wickhami (Horn 1894:420). Arizona.
=*liberta* Casey 1912:171 NEW SYNONYMY
Asidina furcata (Champion 1892:499). Texas, Mexico.
Asidina confluens (LeConte 1851:128). California, Arizona, Mexico.
Asidina semilaevis (Horn 1870:284). Nevada, Arizona, California.

ACKNOWLEDGEMENTS

A number of individuals have contributed to the accuracy of this report. We especially appreciate the careful comparisons made for us by C. M. F. von Hayek, British Museum (Natural History) and the collecting efforts of Dr. Stanley C. Williams, who contributed an enormous number of specimens for study. T. J. Spilman, United States National Museum of Natural History, as always, has been helpful in countless ways as have the curators of all the collections from which we requested specimens. We sincerely thank the institutions and individuals who loaned specimens for this study as follows (4 letter abbreviations proposed by Arnett and Samuelson (1969) are utilized insofar as possible):

American Museum of Natural History, New York [AMNH]; Arizona State University, Tempe [ASUT]; British Museum (Natural History), London [BMNH]; California Academy of Sciences, San Francisco [CASC]; California Insect Survey, Berkeley [CISC]; Canadian National Collection of Insects, Ottawa [CNCI]; Cornell University, Ithaca, New York [CUIC]; Field Museum of Natural History, Chicago [FMNH]; Florida State Collection of Arthropods [FSCA]; Iowa State University, Ames [ISUI]; Kansas State University, Manhattan [KSUC]; Kirby W. Brown, personal collection [KWBC]; Los Angeles County Museum of Natural History, Los Angeles, California [LACM]; Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts [MCZC]; Muséum National d'Histoire Naturelle, Paris [MNHN]; Northern Arizona University, Flagstaff [NAUF]; The Ohio State University Collection of Insects and Spiders, Columbus [OSUC]); William Rosenberg, personal collection; University of Alberta, Edmonton [UASM]; University of Arizona, Tucson [UAIC]; University of California, Davis [UCDC]; Snow Entomological Museum, University of Kansas, Lawrence [SEMC]; United States National Museum of Natural History, Washington, D. C. [USNM].

Special thanks is expressed to Glenn L. Berkey, Photography Department, Ohio Agricultural Research and Development Center, Wooster, for his painstaking skill in preparing the photographs for this paper.

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THE GENUS *RHAGONYCHA* ESCHSCHOLTZ IN NORTH AMERICA[1] (COLEOPTERA: CANTHARIDAE)

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ABSTRACT

The name *Rhagonycha* has been used as a full genus by most Europeans, although considered as a subgenus of *Cantharis* by North American workers. It is here considered a valid genus, and the 43 North American species are listed along with their synonyms.

The genus *Rhagonycha* Eschscholtz has been recognized as a genus distinct from *Cantharis* by European coleopterists for many years. Its recognition in this country has been, at best, as a subgenus of *Cantharis* by McKey-Fender (1950), who at the time acknowledged that it might properly be considered a distinct genus. Prior to this Green (1940), in a revision of the group, indicated that a division of *Cantharis* should be studied. Neither Green nor McKey-Fender pursued the matter further. W. Wittmer, Basal, Switzerland, (in correspondence) expressed his regrets that they did not see fit to so do. Wittmer agrees with me that the group studied by Green should be assigned to the genus *Rhagonycha.* Also included should be 3 species ascribed to *Cantharis* by Miskimen (1956).

The North American species of *Rhagonycha* are small (7.5mm or less long) and monotonously similar in structure and appearance. The third tarsal segment is simple with the insertion of the fourth segment apical. In other members of the old genus *Cantharis,* the third tarsal segment is apically emarginate with the insertion of the fourth segment ante-apical.

Green has seen specimens of *Rhagonycha fulva* Scopoli labeled "Tex", but he was suspicious of the records. He felt that these should be confirmed by recent collections before the species was added to our lists. To date, no additional specimens have been seen from North America. For these reasons, *Rhagonycha fulva* is for the present omitted.

The following list and synonymy of the North American species of *Rhagonycha* is taken from Green's study with the addition of the 3 species more recently described by Miskimen. The synonyms are indented.

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[1] This study was supported by National Science Foundation grant, GB-6283X

CHECKLIST OF N. A. *RHAGONYCHA*

- angulata Say
- antennata Green
- campestris Green
- cartwrighti Green
- cloughi Miskimen
- coloradensis Green
- costipennis LeConte
- cruralis LeConte
- degener Blatchley
- excavata LeConte
- fenderi Miskimen
- flavipes LeConte
  - dichroa LeConte
- fraxini Say
  - ater Kirby
  - binodula Mannerheim
  - nigrita LeConte
- greeni Fall
- heterodoxa Green
- hirticula Green
- imbecillis LeConte
  - albolineata Blatchley
- impar LeConte
- lineola Fabricius
  - parallela Say
  - sayi LeConte
- longula LeConte
- luteicollis Germar
  - cinctella LeConte
- mandibularis Kirby
  - nigritula LeConte
- mimetica Green
- nanula LeConte
- nigriceps LeConte
  - pusilla LeConte
  - mollis Fall
  - ssp. mima Fall
- nigrohumeralis Green
- oriflava LeConte
- parvicollis Green
- picticornis Green
- proxima Green
- recta Melsheimer
  - rufipes Say
  - pusilla LeConte
- ruficollis LeConte
- scitula Say
- seiberti Miskimen
- septentrionis Green
- sylvatica Green
- tantilla LeConte
  - pusio LeConte
- tenuis Green
- triangulifera Green
- umbrina Green
- vestigialis Green
- vilis LeConte

This change, and other current studies, is helping to bring our understanding of the Cantharidae more in line with that of European workers and with modern taxonomic concepts.

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MISKIMEN, G. W. 1956. A faunal list of the Catharidae (Coleoptera) of Ohio with descriptions of new species. Ohio J. Sci. 56(3):129-134; 12 Fig.

A NEW SPECIES OF *SCYMNUS* FROM MARYLAND (COLEOPTERA: COCCINELLIDAE)

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ABSTRACT

Scymnus (*Scymnobius*) *gordoni* n. sp. is described from College Park, Maryland. The male genitalia and the female internal genitalia are figured.

I have placed the following new species of *Scymnus* in the subgenus *Scymnobius* Casey. I have some reservations at this time about whether

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[1] Research Associate, Florida State Collection of Arthropods, Contribution No. 219, Bureau of Entomology, Division of Plant Industry, Florida Department of Agriculture and Consumer Services, Gainesville.

Scymnobius Csy. is a synonym of *Nephus* Mulsant. The eyes seem to be much less emarginate in *Scymnobius* than in *Nephus*, and the metacoxal line of *Scymnobius* is similar to that of *Parascymnus* Chapin figured in Chapin 1965:208, as opposed to the figure of *Nephus* 1965:200.

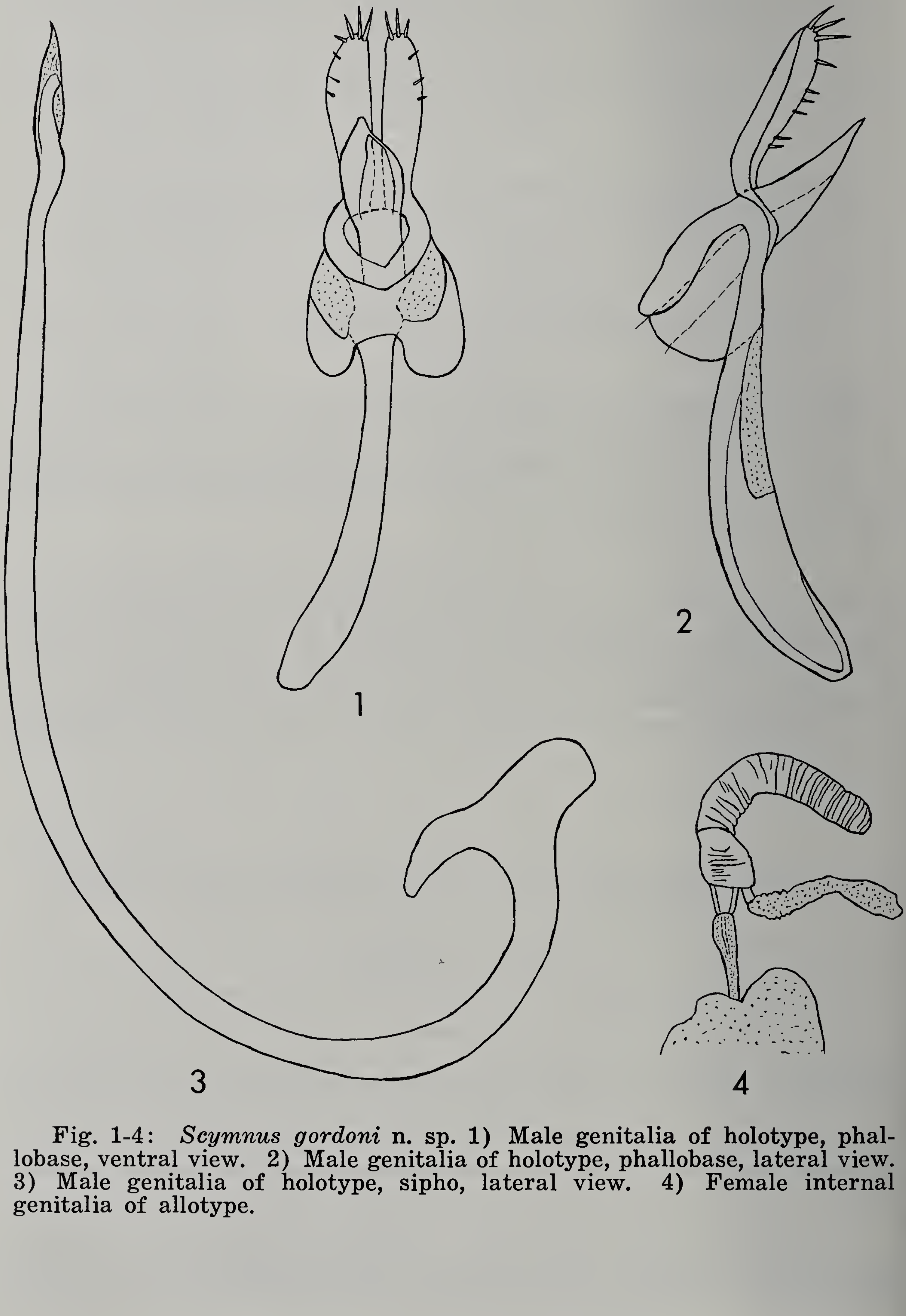

Fig. 1-4: *Scymnus gordoni* n. sp. 1) Male genitalia of holotype, phallobase, ventral view. 2) Male genitalia of holotype, phallobase, lateral view. 3) Male genitalia of holotype, sipho, lateral view. 4) Female internal genitalia of allotype.

Scymnus (*Scymnobius*) *gordoni* Dozier, NEW SPECIES
(Fig. 1-4)

HOLOTYPE MALE: Oval. Side of pronotum curved fairly uniformly into the side of the elytron.

Head: Dull red, ferrugineous; minutely and closely punctate; heavily pubescent; eyes apparently entire but acutally minutely emarginate, finely faceted, pubescent; epistoma short and truncate.

Pronotum: Entirely dull red, ferrugineous; minutely and closely punctate; heavily pubescent. Pubescence at center of the base inclinate toward midline; remaining pubescence generally inclinate toward apex.

Elytra: Black; apical bead and very tip edge (apical 1/32) brown; humeral callus distinct; minutely and shallowly, closely, punctate; heavily pubescent. Pubescence swirled in an "S" pattern (i.e. basal 1/4 inclinate laterally, second 1/4 inclinate apically and then toward the suture, apical half inclinate laterally).

Underside: Prosternum ferrugineous; slightly convex, punctate, pubescent, not carinate. Meso- and metasterna black punctate, pubescent. Elytral epipleura brown. Abdominal sternites black (5th sternite appeared brown prior to dissection and placing in KOH), finely punctate, pubescent. First sternite not modified in the middle. Inner portion of metacoxal line evenly arcuate, line not attaining apex of segment, extending laterally nearly parallel to apex of segment to a point near lateral edge. Distance between metacoxal line and apex of segment approximately 1/4 length of metacoxal plate. Inner 1/3 of metacoxal plate less densely punctate, lateral 2/3 densely punctate. Sixth sternite very short, small, truncate or very slightly emarginate at center, apical hair thicker and longer on each side of center, sparse in center. Legs and tarsi entirely ferrugineous.

Genitalia: Shown in Fig. 1-3.

ALLOTYPE FEMALE: Abdominal sternites brown. Sixth sternite very small but rounded, normal. Metacoxal plate more densely punctate than in male. Internal genitalia shown in Fig. 4.

Length: holotype, 1.9mm; allotype, 2.1mm; paratypes 1.8-2.05mm.

Width: holotype, 1.3mm; allotype, 1.4mm; paratypes 1.3-1.45mm.

SPECIMENS EXAMINED: *Holotype*: Maryland, College Park, 15-IX-68, H. L. Dozier, sweeping chinquapin oak. *Allotype*: Maryland, College Park, 26-VIII-67, H. L. Dozier. *Paratypes*: (2 males, 3 females) all same data as types except: 15-IX-68, 1 male [U.S. Nat'l. Mus] and 2 females [1 Florida St. Colln. Arthropods]; 22-IX-68, 1 male; 8-IX-68, 1 female. The holotype, allotype, and all paratypes (except those noted) are in my collection.

It will run to the subgenus *Scymnobius* in Casey's (1899) key but goes no further because the elytra are black and have no spots or markings.

I am indebted to Dr. Robert D. Gordon for his dissections of the genitalia of the type series, and I take pleasure in naming this species after him in recognition of his work on the Coccinellidae.

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Book Review

Curculionidae Tribe Ophryastini of North America (*Coleoptera*) by David G. Kissinger. Taxonomic Publications, S. Lancaster, Mass; 238 p., 14 Tables, 128 Figures; 1970.

In this monograph Kissinger continues his study of North American weevils. The tribe *Ophryastini* contains 2 genera, *Deracanthus* and *Ophryastes.* The former genus occurs in central Asia and *Ophryastes,* containing 48 known species, is found mostly in the arid southwestern part of the United States and Mexico. Two species range up through the Rocky Mountains into Canada. Members of the genus are large wingless beetles that feed on desert plants.

Kissinger presents a key to the species, followed by detailed descriptions of each. Four of the 48 species are described as new. The figures consist of photographs of mounted weevils and genitalia, line drawings, and a series of maps showing the distribution of each species. The tables contain measurements of 9 variables (e.g. length of rostrum, width of frons, etc.) for males and females of each species. For each of these 9 variables, the means, standard deviations, and maximum and minimum values are given.

Up to this point we have the traditional monograph. In the last 12 figures the author presents the results of applying statistical procedures by means of computer programs to this data. First he applied a principal component factor analysis to these 9 measurements made on both males and females. This resulted in length of elytra, width of elytra, and the maximum width of the pronotum accounting for most of the variance. The disadvantage of this type of analysis was thereby demonstrated because significant taxonomic characteristics were not identified. Then he made a multiple discriminant analysis to see, if by this method and using the same 9 measurements, 1 species could be separated from another. With minor exceptions, the discriminant function was able to assign individuals to the correct species with probabilities between .95 and 1.00. However, it should be noted that he used species in this analysis that were not closely related ones.

This monograph is up to Kissinger's usual excellent work. The composition of the work and its reproduction are very good. The statistical analysis may be indicative of what we may expect in the future. Altogether it is an excellent job.—N. M. Downie

BOOK REVIEW

The environmental destruction of south Florida edited by W. R. McCluney. 1971. University of Miami Press, Drawer 9088, Coral Gables, Florida, 33124. 134p.; 3 maps; paper; $1.95.

There is probably no area of comparable size in the U. S. which is more likely to have its fauna and flora depleted than south Florida. This book will help to call attention to this rapid destruction, but it is a far cry from the great naturalist's books on the subject (e. g. W. S. Blatchley's *In days agone* (1932); J. K. Small's *From eden to sahara—Florida's tragedy* (1929), or Thomas Barbour's *That vanishing eden—a naturalists Florida* (1945).

The most authoritative and redeeming part of the book is one of its 21 chapters by the indefatigable F. C. Craighead. Who among our readers does not know his work with Böving on Coleoptera larvae or his thorough book on the insect enemies of eastern forests? His first visit to south Florida in 1918 enables him to discuss the area in perspective. He has worked there for more than 15 years since his retirement and is fully aware of man's role in destroying our subtropical environment, along with its flora and fauna.—R. E. Woodruff.

COLOR CHANGES BY ADULTS OF THE TORTOISE BEETLE, *PHYSONOTA HELIANTHI* (RANDALL) (COLEOPTERA: CHRYSOMELIDAE)

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ABSTRACT

Previously the number of generations per year and adult coloration of *Physonota helianthi* (Randall) have been recorded erroneously or incompletely. It is univoltine in South Dakota and overwinters as an adult. It goes through 3 color changes: 1) dingy white (teneral adult), 2) black-and-white (intermediate phase of about 3 weeks), and 3) iridescent green (mature adult). The intermediate phase appeared to be correlated with feeding on the host (normally *Helianthus grosseserratus* Martens) rather than surroundings or disturbance.

Taxonomically, the identity of *Physonota helianthi* (Randall) seems to have been settled, but there is erroneous or incomplete information regarding the number of generations, the color of specimens, and the number of spots on the pronotum. Thus, Randall (1838) described living specimens as "blackish, irregularly spotted with white," having 3 black spots on the pronotum, and feeding on a species of wild sunflower (*Helianthus* sp.). From what appear to have been cabinet specimens, Walsh (1869) described another species (*P. quinquepunctata*) as also feeding on *Helianthus*; this insect was "more or less pale dull olive color, dotted with pale yellow," with 5 spots on the pronotum, 3 of which were black, and 2 dark olive spots sometimes confluent. However, Caulfield (1886) noted that 2 olive spots appeared to be the only difference between the 2 species. He also observed that these 2 spots fade soon after death and become almost imperceptible in old museum specimens, while the 3 posterior spots retain their color. He therefore synonymized *P. quinquepunctata* under *P. helianthi*. This opinion was confirmed by Sanderson (1948), who also worked with museum specimens; he referred to the elytra as being "usually distinctly mottled with creamy yellow spots."

Caulfield (1884) additionally reported that *P. helianthi* is "double-brooded in Montreal, occurring in June and again in August, but the broods when living present a very different appearance. The beetles of the first brood are entirely of a burnished gold color, and are exceedingly beautiful. The fall brood show no trace of gold and answer Randall's description, except that I would call them blackish green. . . . with yellowish white spots. After death both broods fade to a dingy yellow, and are exactly alike." After further study, Caulfield (1886) concluded that *P. helianthi* may possess the power of assuming different tints as is the case with some other species of the family. He observed that all adults from field-collected larvae were pure black and white when living but faded soon after death. He did not say how long these adults lived.

During 1967, 1968, and 1969, *P. helianthi* was the major insect pest of the wild sunflower (*Helianthus grosseserratus* Martens) in eastern South Dakota. Both adults and larvae fed on the underside of the leaves and occasionally defoliated the plants.

I found adults laying eggs on this host in late June of each of the 3 years. They were iridescent green with a tint of gold, and the pronotum of each had both the 3 black spots described by Sanderson (1948) and the 2 nearly confluent spots described by Walsh (1869). However, the confluent spots had dark green centers surrounded by a faint light green ring. The green color of these overwintered insects faded within a month after specimens had been killed, and they became a dull gold with a faint cast of green.

By August, no green (overwintered) adults could be found, and teneral adults of the new generation were appearing on the plants. The elytra of the young adults were black with a white margin and were distinctly mottled with white by the third day after emergence. The pronotum was white with 5 black spots; on some speciments, the 2 anterior spots were as black as the other 3, but on most, they were merely transparent areas that appeared dark because of depth, without pigmentation.

The black-and-white coloring also changed within a month after adults of the new generation were killed and pinned. The mottled spots and the margin were still visible but were dull gold; the previously black areas assumed an olive-green cast beneath the dull gold. On the pronotum, the 3 posterior spots remained black and the 2 anterior spots faded to gray on most beetles, though they remained black on others.

The black-and-white color phase proved to be merely an intermediate one between the dingy-white or ivory of the teneral adult and the iridescent green of the mature adult. About half the beetles found during the last week of August were either iridescent green or some intermediate shade between black-and-white and green; the other beetles were still black-and-white. Several black-and-white adults, given *H. grosseserratus* leaves to eat in the laboratory, turned green by the end of the third week.

Although Caulfield (1884) could see no difference between the color phases several weeks after death, I found them to be easily distinguishable. The elytral mottling of specimens that had been labeled black-and-white was obvious, even after 2 years in the collection cabinet, and the previously black areas were a definite olive-green beneath a dull gold. The specimens that had been green when alive were dull gold with a very faint green cast.

I found no evidence that the adults are able to change their hue or brilliance according to their surroundings or from being disturbed, as do some species in this subfamily. However, it was possible that the color changes observed in *P. helianthi* might be associated with food. Prokop (1969) found this true of the eastern hercules beetle, *Dynastes tityus* (L.). Mature specimens of *P. helianthi* were given leaves of *H. grosseserratus* to eat in the laboratory from 8 September to 10 October 1968, then they were put in a container of damp peat moss and kept at 4°C. Several specimens had partially reverted to the black-and-white coloration by 12 February 1969, and all were dead by 30 March, probably because they had used up their food reserves. I have seen 2 or 3 specimens in the field that were intermediate color phases in early June, long before any eggs or larvae could be found on the host plants. It therefore appears that at least some of the beetles overwintering in natural sites revert toward the black-and-white phase.

In South Dakota, *P. helianthi* is univoltine, and I believe it must be throughout its range in northern United States and Canada. I found no evidence of a second brood or generation. Larvae were present from late

June to early September, but they all appeared to be progeny of the overwintered beetles. I found adults ovipositing between late June and late July, but none were seen ovipositing after 1 August. Furthermore, no newly laid egg masses were found later in the summer, indicating that the new generation was not reproductively active until the following summer. The dates given for the "spring brood" (June) in Montreal (Caulfield 1884) agree with the time of appearance of the overwintered adults in South Dakota, and the adults of the "fall brood" (August) agree with the appearance of the first young adults in South Dakota.

ACKNOWLEDGMENTS

I would like to thank Charles A. Taylor, Botanist at South Dakota State University, for identifying the host plant; Edward U. Balsbaugh, Jr., Entomologist at SDSU, for identifying the insect; and Gerald R. Sutter, Entomologist, USDA, for taking the photograph (Fig. 1).

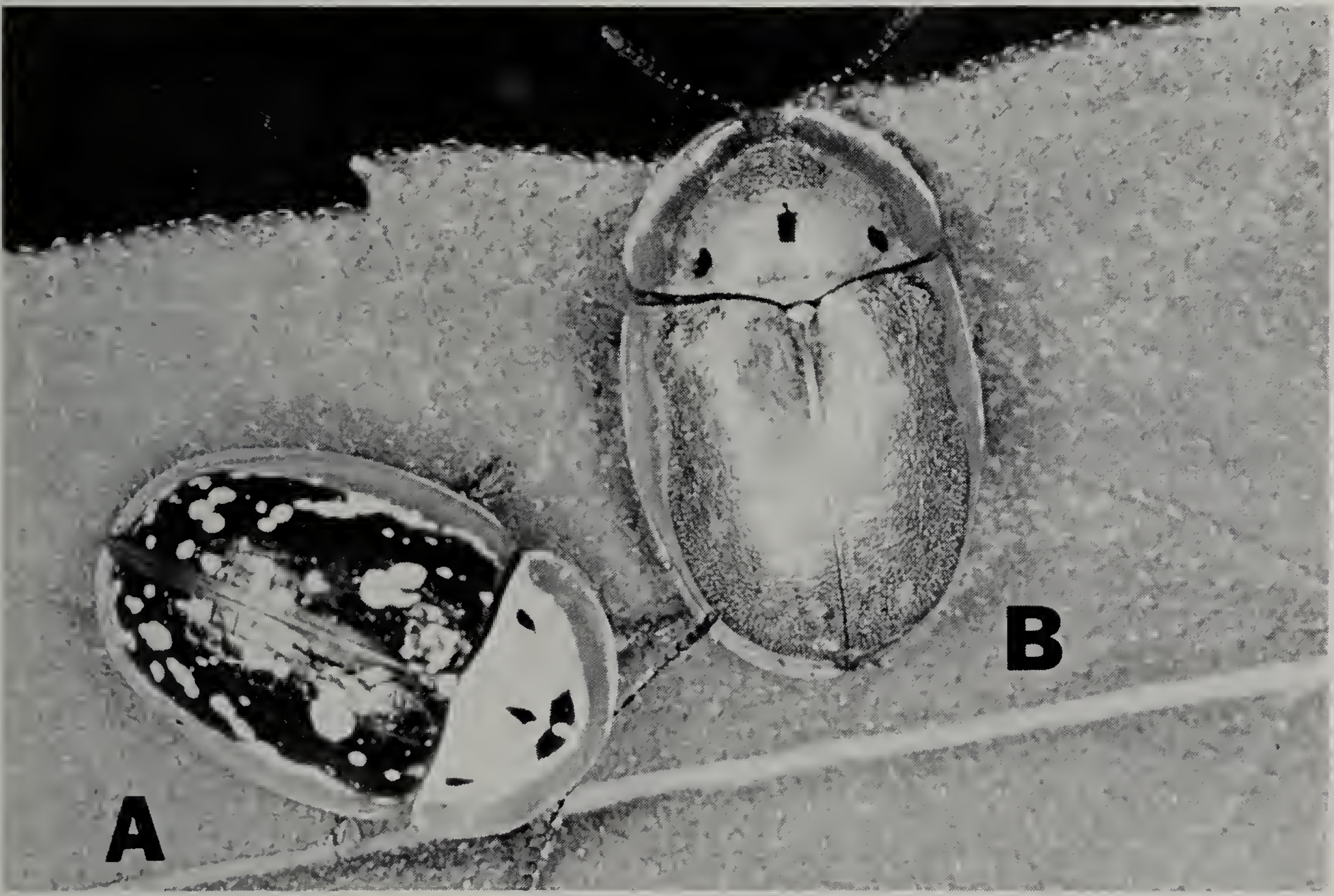

Fig. 1. (A) Intermediate (black-and-white) stage of *Physonota helianthi* between teneral and mature adult; (B) mature adult.

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BOOK REVIEW

Entomological information storage and retrieval by Ross H. Arnett, Jr. 1970. Bio Rand Foundation, Inc., 1330 Dillon Heights Ave., Baltimore, Md. 21228. 210p.; cloth; $7.95.

The author of this volume certainly needs no introduction to our readers, being current President of the Coleopterists Society and founder of the Coleopterists Bulletin. Aside from these activities, he is eminently qualified to write such a text because of his membership on the Special Committee on Information Retrieval of the Entomological Society of America and because he taught a course on the subject at Purdue University.

The subject matter of the book is of primary interest to all entomologists and librarians. It is unfortunate that there are so few courses on the subject in most University curricula. Although publishing is a life or death matter to a research entomologist, he rarely obtains direct training which will assure quality research papers. The difficulties in determining what research has already been done discourages many students from the profession. This book will be of great assistance in both these regards.

Such a title cannot begin to convey the complexity of the subject matter. It is also a rapidly changing area of study, in which computers and other new equipment must provide assistance so that the entomologist can get on with his research. The scope of the book is reflected in the chapter titles: The informational problem; Information storage & retrieval systems theory; Stored information; Original documents; Preparation of original documents for information storage; Preparing documents for information retrieval; Search resources; Abstracts and indexes; Synthesized information; Popular literature; Societies, institutions, and personnel. It has an excellent glossary of many terms new to entomologists and appendices consisting of 1) bibliography of basic types of entomological literature; 2) selected list of commercial publishers and dealers in entomological literature; 3) entomological equipment and supply companies; 4) major entomological libraries of the U. S. and Canada.

No other book is available which covers this area of entomological activity in an up-to-date manner and with numerous innovations. Such a treatise must cover many topics briefly, but the reader is guided to the source information for greater depth. Key items of each chapter are isolated in eye-catching study blocks. Assignments, many of which are original and stimulating, are provided for use in a course. There are many optional assignments and investigations, making the book useful for seminar-type courses or a 5-hour formal course. Review checklists at the end of each chapter help to provide a check on the reader's understanding of the text.

There are few mechanical errors (due to the skill with which Dr. Arnett personally typed the composition for offset), and the general make-up is well organized. The only wish I would make is that it might be twice its length, in order to provide more detailed data such as the appendices and for more of Arnett's innovative ideas. I recommend it for every entomologist, but especially as the text for a course which no entomology department should be without.—R. E. Woodruff.

NEOTROPICAL DRYOPOIDS. III. NEW RECORDS OF *XENELMIS*, WITH A DESCRIPTION OF THE LARVA (COLEOPTERA: ELMIDAE).

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Abstract

A total of 544 adults of *Xenelmis* are reported from Mexico: states of Chiapas, Colima, Guerrero, Jalisco, and Morelos; Guatemala: Dept. of Guatemala, Jutiapa, Retalhuleu, and Suchitepequez; Nicaragua: Dept. of Granada; Costa Rica: Dept. of Puntarenas; Panama: Prov. of Chiriquí, Coclé, and Panamá; Venezuela: states of Carabobo and Cojedes. A total of 203 larvae were collected from 10 localities in Mexico, 2 in Panamá, and 1 in Venezuela, either in association with adults or near sites where adults were found. The mature larva of *X. bufo* (Sharp) is described and figured, generic characteristics are outlined, and instructions are given for inclusion of *Xenelmis* in Bertrand's and Hinton's keys to larval elmids. Larvae and adults occur in sandy or gravelly streams.

Introduction

Of the genera of elmids known from North America (including Mexico), the larvae of only 2 remain unknown: *Atractelmis* Chandler from California and *Xenelmis* Hinton from Mexico and southward. *Atractelmis* is apparently rare, being known from very few specimens taken in a couple of localities. Although I have sought *Atractelmis*, I have succeeded in collecting only one adult (a female, from the type locality at Wawona in Yosemite National Park) and no larvae. *Xenelmis*, on the other hand, is relatively common and widespread, ranging from central Mexico through much of South America. I have collected 550 adults and 203 larvae which are almost certainly those of *Xenelmis*. These larvae are from 10 localities in Mexico, 2 in Panama, and 1 in Venezuela. In 10 of the 13 localities, adults of *Xenelmis* were found in association with the larvae; in the other 3 sites, adults of *Xenelmis* were located on the same date within a few miles of the larval collecting sites. The larvae are of appropriate dimensions and aspect to yield adult *Xenelmis*. In no case was any other genus found with which the larva might be associated, although as many as 13 other genera of dryopoids were present in the same locality. Thus, in spite of the absence of proof through rearing, there is little doubt that the larva here described is that of *Xenelmis*. Furthermore, since the adults in all of the localities concerned appear to be *X. bufo* (Sharp) 1882, the larvae probably represent this species. Identification is based on Hinton's key (1946). The nearest region from which Hinton (1940, 1946) cited any other species was the Amazon basin of Brazil. The only subsequent records of *Xenelmis* are those of Delève (1968), who described a species from Ecuador, and Brown (1970), who described one from the State of Pará, Brazil.

Generic Characters of the Larva of *XENELMIS*

Body convex, broadly rounded anteriorly, tapering posteriorly from second abdominal segment; hemispheric in cross-section (Fig. 1-3).

Head usually concealed by pronotum when viewed dorsally, although it can be extended from beneath pronotum; anterior margin without tooth

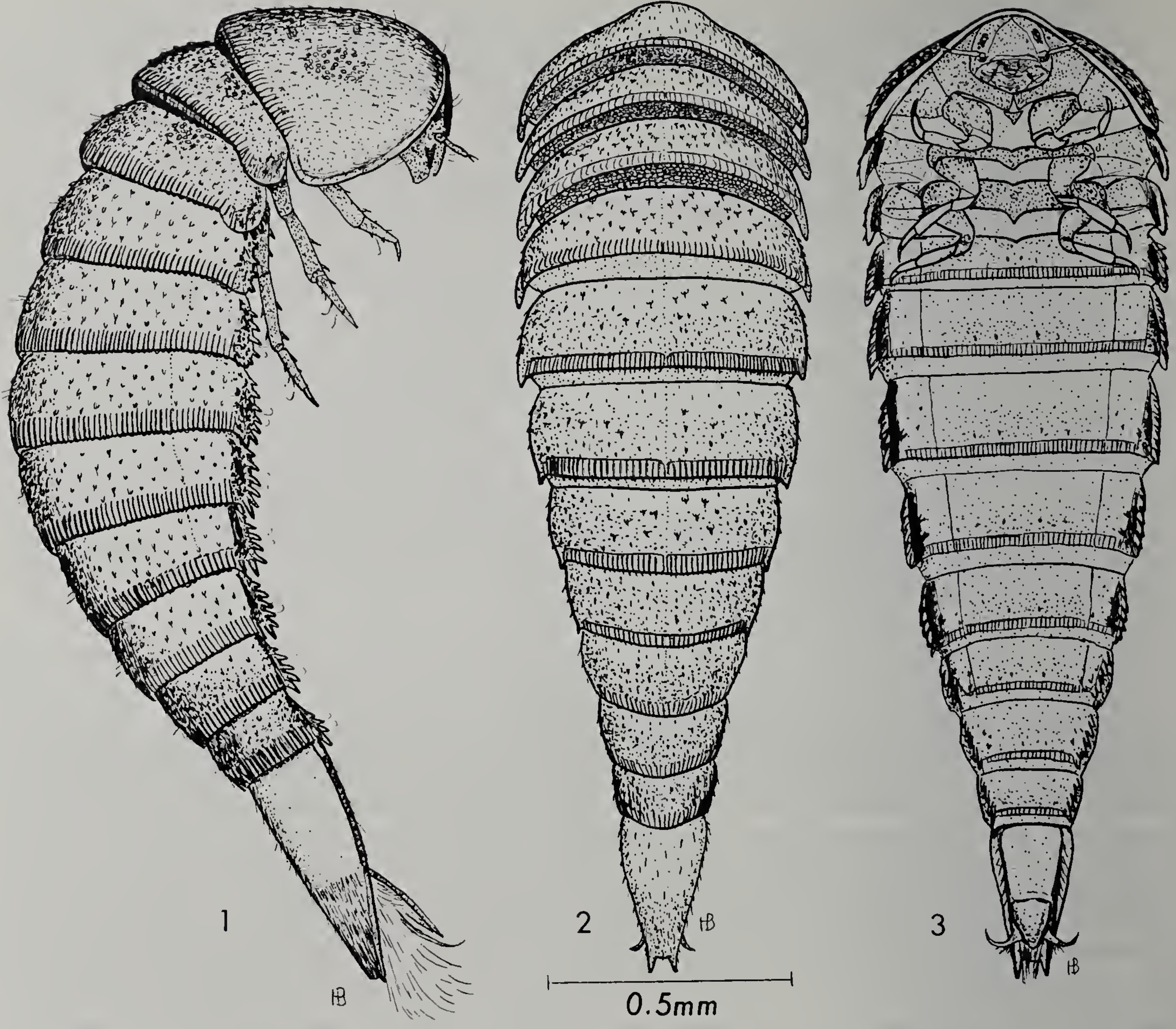

Fig. 1-3: *Xenelmis bufo* larva; 1) lateral aspect, 2) dorsal aspect, 3) ventral aspect.

between base of antenna and clypeus (Fig. 4). Each eye with 5 (?) ocelli in a compact group. Antennae 3-segmented. Mandibles of both sides similar and with 3 rather obtuse apical teeth; prostheca slender and densely setose (Fig. 5). Maxillary palp 4-segmented, the basal segment very short and inconspicuous; stipes showing no differentiation into a palpifer; galea and lacinia separate, each spinose apically (Fig. 6). Labium with postmentum undivided; labial palp 3-segmented and prementum without a distinct palpiger. Gula well developed.

Prothoracic pleura divided into 2 parts, the anterior parts of the 2 sides barely meeting midventrally; procoxal cavities open posteriorly, partially separated in the middle by a small median sclerite (Fig. 3). Meso- and metapleura divided into 3 parts.

Abdominal segments 1-6 with pleura bounded by tergo- and sternopleural sutures; these sutures converging but not quite meeting at apex of sixth segment. Segments 7 and 8 without pleura, but apparently with tergosternal sutures. Operculum with 2 well-sclerotized claws attached to its dorsal membrane. Apex of ninth segment deeply and acutely emarginate. Lateral margins of abdominal segments produced posteriorly and heavily spined. Spiracles present on mesothorax and first 8 abdominal segments, opening laterally. Tracheae without air sacs.

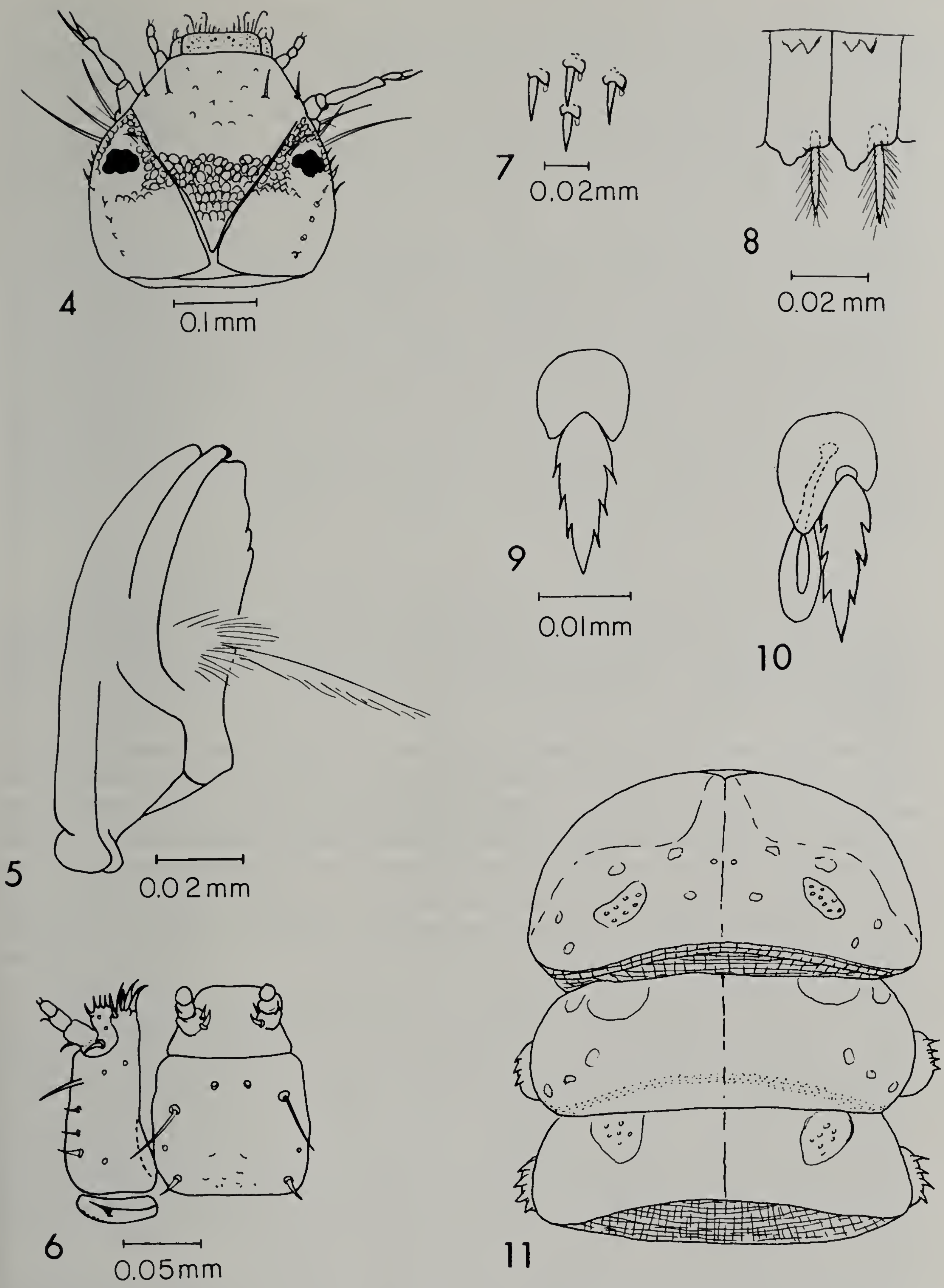

Fig. 4-11: *Xenelmis bufo* larva; 4) dorsal aspect of head, 5) left mandible, 6) right maxilla and labium, 7) tubercles and setae from first abdominal tergite just to the right of mid-dorsal line, 8) scale-like tubercles and delicate plumose hairs which form the posterior margin of third abdominal tergite just to the left of mid-dorsal line, 9) tubercle and serrate seta from fifth abdominal sternite, 10) tubercle with serrate seta and "bladder" from fifth abdominal left pleurite, 11) dorsal aspect of thorax showing patches devoid of setae.

The larvae of *Xenelmis* do not seem very close to those of any other genera known from the Western Hempisphere. In general appearance, they are reminiscent of the larvae of the European *Elmis*, being somewhat onisciform. Of New World forms, they are perhaps closest to larvae of *Macronychus*, with which they share such characters as possession of only 6 pairs of abdominal pleura, bipartite propleura, procoxal cavities open posteriorly, and apex of ninth abdominal segment emarginate. From the larvae of *Macronychus* they differ in possessing tripartite meso- and metapleura, a more convex body, and prominent spines along the lateral margins of the abdominal segments. The larvae of *Macronychus* occur on and feed on wood, as do the adults, whereas the larvae and adults of *Xenelmis* occur in sand or gravel in riffles. Ecologically, they are similar to the larvae of *Optioservus* and *Oulimnius* (formerly known as *Limnius*), which they also resemble in general aspect and in having open procoxal cavities. *Xenelmis* larvae differ from them in many respects, including the possession of only 6 abdominal pleura, bipartite instead of tripartite propleura, and tripartite instead of mono- or bipartite meso- and metapleura.

DESCRIPTION OF MATURE LARVA OF *XENELMIS BUFO* (SHARP)

Length 2.7mm, width 0.7mm. Body hemispheric in cross section. Thoracic segments and first 2 abdominal segments subequal in width, the remaining abdominal segments tapering conspicuously toward apex (Fig. 1-3).

Head brown above, testaceous below and on sides. Body generally ashy brown above except antero-lateral portions of pronotum, first abdominal segment, and anterior half of ninth abdominal segment, all of which are testaceous. Posterior margins of all segments with a darker border. Legs and ventral sclerites of thorax pale, dusky, and translucent. Sternites and pleurites of first 8 abdominal segments also pale, dusky, and translucent. Ventral surface of ninth abdominal segment testaceous, shading toward brown apically, the operculum light brown. In some specimens the first abdominal tergite is as dark as the remaining ones; in others (perhaps recently molted) the dorsal thoracic and first 6 abdominal segments are almost uniformly testaceous. Intersegmental membranes dark above, armored with a fine reticulum of minute plates; ventral intersegmental membranes lighter in color, generally a pale gray to testaceous.

Dorsal sclerites rather sparsely covered with small, most bidentate tubercles, each of which gives rise to a stout seta and a small, delicate, bladder-like process (Fig. 7). Posterior margins of first 8 abdominal tergites bordered by a close-set row of elongate, flattened, apically dentate tubercles, each bearing a delicate plumose hair (Fig. 8).

Head capsule broadly rounded and truncate behind. Region around and between eyes densely covered with small, scale-like tubercles (Fig. 4); a few scattered flattened tubercles across frons. Setal pattern as shown. Frontal sutures well developed and extending on each side from base of antenna to unite medially just ahead of posterior margin. Ocelli conspicuous. Labrum transverse; anterior margin truncate, anterior angles abruptly rounded; bordered by pale, slender setae, some of which are recurved. Mandibles each with 3 obtuse apical teeth and a slender, setose prostheca (Fig. 5). Maxilla with palp 4-segmented, the basal segment very short and sometimes difficult to detect; galea and lacinia subequal in size and densely spinose at apex, the lacinia more heavily sclerotized and with no joint or suture (Fig. 6). Labium with mentum quadrate, about as long as broad; prementum tapering apically, with apical angles broadly rounded and apical margin truncate; labial palps short, plump, and 3-segmented (Fig. 6).

Pronotum about twice as broad as long, narrowed anteriorly, with rounded angles; broadly convex; on each side near basal two-fifths and halfway between midline and lateral border with a semilunar patch devoid of setae and bearing flattened tubercles, and other similar smaller patches as shown in Fig. 1 and 11. Mesonotum about 3 times as wide as long; lateral margin slightly and roundly produced posteriorly, with several small marginal spines; on each side with patches devoid of setae as shown in Fig. 11. Metanotum slightly more than 3 times as wide as long; lateral margin roundly produced posteriorly, with about 5 prominent marginal spines; on each side with an inconspicuous patch devoid of setae bordering the anterior margin about half way between midline and lateral margin.

First 2 abdominal segments subequal in width to thorax, the third a little narrower, and the remaining segments progressively narrower (Fig. 2, 3). First abdominal segment usually lighter in color than thoracic segments and the other abdominal segments. Tergites of abdominal segments 1-8 bordered posteriorly with a row of flattened, elongate, subquadrate tubercles, each bearing one or more apical teeth and a plumose hair (Fig. 8). These marginal dentate tubercles become progressively more prominent toward the rear. Lateral margins of first 8 segments directed ventrally and produced posteriorly, bordered by stout spines. Ninth abdominal segment about twice as long as wide; widest at or just beyond base, basal half testaceous, much lighter than apical half; lateral borders extended posteriorly to form 2 prominent, acute apical teeth; without dorsal carina.

Ventral thoracic sclerites almost devoid of tubercles and setae except medially along posterior margin of mesothoracic and metathoracic sternites, where a few stout setae and flattened, apically dentate, tubercles occur. Abdominal sternites translucent, with sparsely scattered, flattened tubercles bearing serrate setae (Fig. 9); apical margins of the more posterior segments bearing flat, dentate tubercles. Abdominal segments 1-6 with pleura which are difficult to observe except in cleared specimens. The pleurites also translucent and with flattened tubercles bearing serrate setae; in addition, these tubercles bear bladder-like processes (Fig. 10). Pleurites 2-6 with a marginal lateral row of setae which are enlarged and spine-like, especially toward the posterior. Ninth abdominal segment with longer, slenderer setae; opercular claws slender.

SPECIMENS EXAMINED: Mexico: Estado de Colima, La Estancia, 24-III-70, 13 larvae with 1 adult; San Cayetano, 24-III-70, 14 larvae with 24 adults; El Trapiche, 24-III-70, 8 larvae with 13 adults; El Cóbano, 25-III-70, 29 larvae with 261 adults; El Cóbano, 9-VIII-70, 4 larvae with 10 adults; Comala, 26-III-70, 6 larvae; Estado de Guerrero, Xaltianguis, 30-III-69, 69 larvae with 14 adults; El Ocotito, 2-IV-69, 4 larvae; Tierra Colorada, 2-IV-69, 2 larvae with 2 adults; Saucito, 4-IV-69, 29 larvae with 2 adults; El

Limon, 4-IV-69, 22 larvae with 23 adults; PANAMA: Provincia Coclé, Candelaria, 25-VI-68, 1 larva; Prov. Panamá, Pacora, 26-IV-68, 1 larva with 1 adult; VENEZUELA: Estado de Carabobo, Tocuyito, 1-VI-68, 1 larva with 2 adults. The description is based on specimens collected at Saucito, Guerrero, México.

ADDITIONAL RECORDS OF XENELMIS: Since *Xenelmis bufo* has previously been reported only from the Estado de México in México and 2 localities in Panamá (Volcan de Chiriquí and San Miguel, Pearl Island), the following additional adult records are presented: MEXICO: Estado de Chiapas, Rio Macuilapa, 2-XI-64, (1); N of Arriaga, 20-X-66, (1); Ixtapa, 4-XII-66, (12); Estado de Colima, Queseria, 25-III-70, (2); Montitlan, 9-VIII-70, (1); Estado de Guerrero, El Cuarenta y Cinco, 5-IV-69, (42); Estado de Jalisco, El Tule, 27-III-70, (9); 8 km S of Tecalitlan, 27-III-70, (2); Estado de Morelos, Rio de Chalma, 22-X-64, (1); GUATEMALA: Departamenta de Retalhuleu, 4 mi. W of Cuyotenango, 23-X-66, (1); Depta. Suchitepequez, ca. 30 mi. W of Escuintla, 24-X-66, (1); Depta. Guatemala, 20 km. NE of Guatemala City, 26-X-66, (2); Depta. Jutiapa, Jutiapa, 28-X-66, (1); NICARAGUA: Depta. Granada, E of Nandaime, 2-XI-66, (11); COSTA RICA: Depta. Puntarenas, Rio Jesus E of Esparta, 4-XI-66, (7); Canoas, 10-XI-66, (1); PANAMA: Chiriquí, Bambito, 23-VI-68, (1) [type locality]; Coclé, Machuca, 25-VI-68, (3); VENEZUELA: Cojedes, Tinaquillo, 1-VI-68, (2). All collections were made by the author.

ECOLOGY: All specimens were taken in relatively clear, shallow, fast-flowing water in gravelly areas or mixed sand and gravel, though in some the sand was preponderant. The streams ranged from small brooks to medium sized rivers. I have collected moderate numbers of adults in various localities during the autumn, without finding larvae. Perhaps they were not present at that season, but it is more likely that I simply missed them. As might be expected from their shape, the larvae, when taken in the net, curl up like tiny armadillos or pillbugs (isopod crustaceans), and readily fall through the mesh. Although I have not observed living larvae in the laboratory, I surmise that in nature the head is generally withdrawn beneath the carapace-like pronotum, and that the colorless, transparent anterolateral portions of the pronotum enable the larva to see reasonably well even when the head is thus protected.

ADDITION OF XENELMIS TO EXISTING KEYS:

The only comprehensive key to the larval elmids of Central and South America is that of Bertrand (1955). To insert the larva of *Xenelmis* into his key, the following changes may be made: On page 137, in couplet 52 (45), delete . . . "angles postérieurs des segments non prolongés . . ."; in couplet 55 (60), delete . . . "mésothorax et métathorax également à deux pièces."; following couplet 55 (60), insert a half-couplet as follows: 55a (69). Mésothorax et métathorax à deux pièces épipleurales. On page 138, at the end of the key, insert the following half-couplet: 69 (55a). Mésothorax et métathorax à trois épipleurales; angles postérieurs des segments de l'abdomen prolongés, les bords lateraux garnis des épines . . . *Xenelmis* Hinton.

To add *Xenelmis* to Hinton's key (1940), it is best to insert it in 2 places, since neither choice in the first couplet is quite appropriate and the reader might choose either. On page 229, after the second choice in couplet 2, replace the lead or guide numeral 3 with 2a and insert the following couplet:

2a. Lateral margins of thoracic and abdominal segments directed ventrally (vertically); body hemicylindrical but tapering. CENTRAL and SOUTH AMERICA .... *Xenelmis* Hinton (1936).
Lateral margins directed laterally (horizontally); body more flattened .... 3.

On page 230, after the second choice in couplet 11, delete "NORTH and SOUTH AMERICA . . . *Heterelmis* Sharp (1882)," replace it with the guide numeral 11a, and insert the folowing couplet:

11a. Procoxal cavities closed behind (prothorax with a median posterior sternite). NORTH and SOUTH AMERICA .... *Heterelmis* Sharp (1882).

Procoxal cavities open behind (prothorax without a median posterior sternite). CENTRAL and SOUTH AMERICA ....*Xenelmis* Hinton (1936).

The following additional corrections should be made to Hinton's key on p. 230: in the first part of couplet 8, replace "*Limnius* Er. (1847)" with *Oulimnius* Des Gozis (1886); to the first part of couplet 9, add WEST INDIES; in the second part of couplet 9, replace "BOLIVIA" with CENTRAL and SOUTH AMERICA; in the first part of couplet 13, replace "*Latelmis* Reitt. (1883)" with *Limnius* Illiger (1802).

Acknowledgments

Fig. 2 and 3 are based on outline drawings made by my daughter, Mary Brown Catron, to whom I am indebted. Fig. 4-11 were inked by our departmental illustrator, Ginna Davidson, to whom I also express thanks.

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Hinton, H. E. 1940. A monographic revision of the Mexican water beetles of the Family Elmidae. Novit. Zool. 42 (2):217-396.

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Sharp, D. 1882. Biologia Centrali-Americana, Insecta, Coleoptera. Haliplidae, Dytiscidae, Gyrinidae, Hydrophilidae, Heteroceridae, Parnidae, Georissidae, Cyathoceridae. 1 (2):1-114.

BOOK REVIEWS

In the previous issue (Coleopt. Bull. 25(2):50) I reviewed catalogues of types in 2 collections. Two additional such papers were brought to my attention by Mr. Herbert Dozier, and they are reviewed here. The editor would appreciate notification of similar lists or catalogues for use in future issues.

Catalogo dos tipos de insectos do Instituto de Ecologia e Experimentacao Agricolas by Walter Zikan & Petr Wygodzinsky. 1949. Boletim do Servico Nacional de Pesquisas Agronomicas, Ministerio da Agricultura (Rio de Janeiro), No. 4; 94p.

This list includes all insects, the Coleoptera being listed on p. 23-66. The collection, on which this list is based, was founded in 1915 at the National Museum in Rio de Janeiro; in 1920 it was transferred under the Biological Institute for Protection of Agriculture; in 1933 to the Institute of Plant Biology; and later the Institute of Ecological and Experimental Agriculture under the National Service of Agricultural Research.

As of Mar. 31, 1948, it contained about 100,000 specimens representing from 20,000 to 25,000 species. In the following list, numbers in parentheses after each family represent the number of species represented by types (holotypes, allotypes, paratypes, cotypes): Dytiscidae (4), Carabidae (1), Cucujidae (5), Meloidae (6), Buprestidae (2), Chrysomelidae (9), Passalidae (4), Lucanidae (5), Scarabaeidae (4), Scolytidae (4), Brentidae (3), Curculionidae (13), and Cerambycidae (313). The great number of Cerambycidae is the result of work by Melzer.

There is an index of families and genera and a page of errata. All label data are listed for each entry. I am certain this collection has grown at a rapid rate and the list is far out of date. It would be very useful for a supplement to be prepared.

A list of zoological and botanical types preserved in collections in Southern and East Africa. Vol. I—Zoology. 1958. Published by the South African Museum's Association; 147p. (Probably out of print, but maybe available from: Director, Transvaal Museum, P. O. Box 413, Pretoria, South Africa).

This list includes all animals, the Coleoptera being listed on p. 20-29. Represented are: Anthicidae (1), Anthribidae (1), Buprestidae (57), Carabidae (57), Cerambycidae (11), Chrysomelidae (75), Curculionidae (111), Dasytidae (2), Dytiscidae (3), Gyrinidae (1), Histeridae (1), Hydrophilidae (6), Languriidae (1), Lycidae (2), Malachiidae (2), Mordellidae (4), Paussidae (2), Ptinidae (1), Scarabaeidae (29), Scydmaenidae (1), Staphylinidae (23), and Tenebrionidae (67).

The holdings are listed up to 1955. Under each entry is listed the museum where it is housed, the number of specimens, and the kind of type.

The systematic biology collections of the United States; Part I. *The great collections: their nature, importance, condition, and future.* 1971. Available from the New York Botanical Garden, The Bronx, N. Y., 10458.

This is an interesting report to the National Science Foundation by the Conference of Directors of Systematic Collections. Unfortunately the authors are not listed, because someone should get credit for the enormous amount of work involved and the straightforward way the report is presented. Money is obviously one of the keys to the future of our museums, and many of the needs are consolidated in this report. I am sure that every taxonomist has long realized the dilemmas of inadequate space, insufficient supporting staff, meagre support for field work and travel, and the general lack of concern about irreplaceable museum collections. I hope this report will help to bring many of these problems to the forefront, not only to NSF, but to the federal and state legislatures who are ultimately responsible for providing the appropriations to support essential museum activities and assuring the preservation of these collections. Faunal and floral studies, verified by museum specimens, are as important a part of "environmentalism" as all the anti-pollution campaigns. We should at least know what we have destroyed.—R. E. Woodruff.

COMMENTS ON CERTAIN COLEOPTERA FROM EXTREME SOUTHERN ONTARIO AND THE OTTAWA DISTRICT[1]

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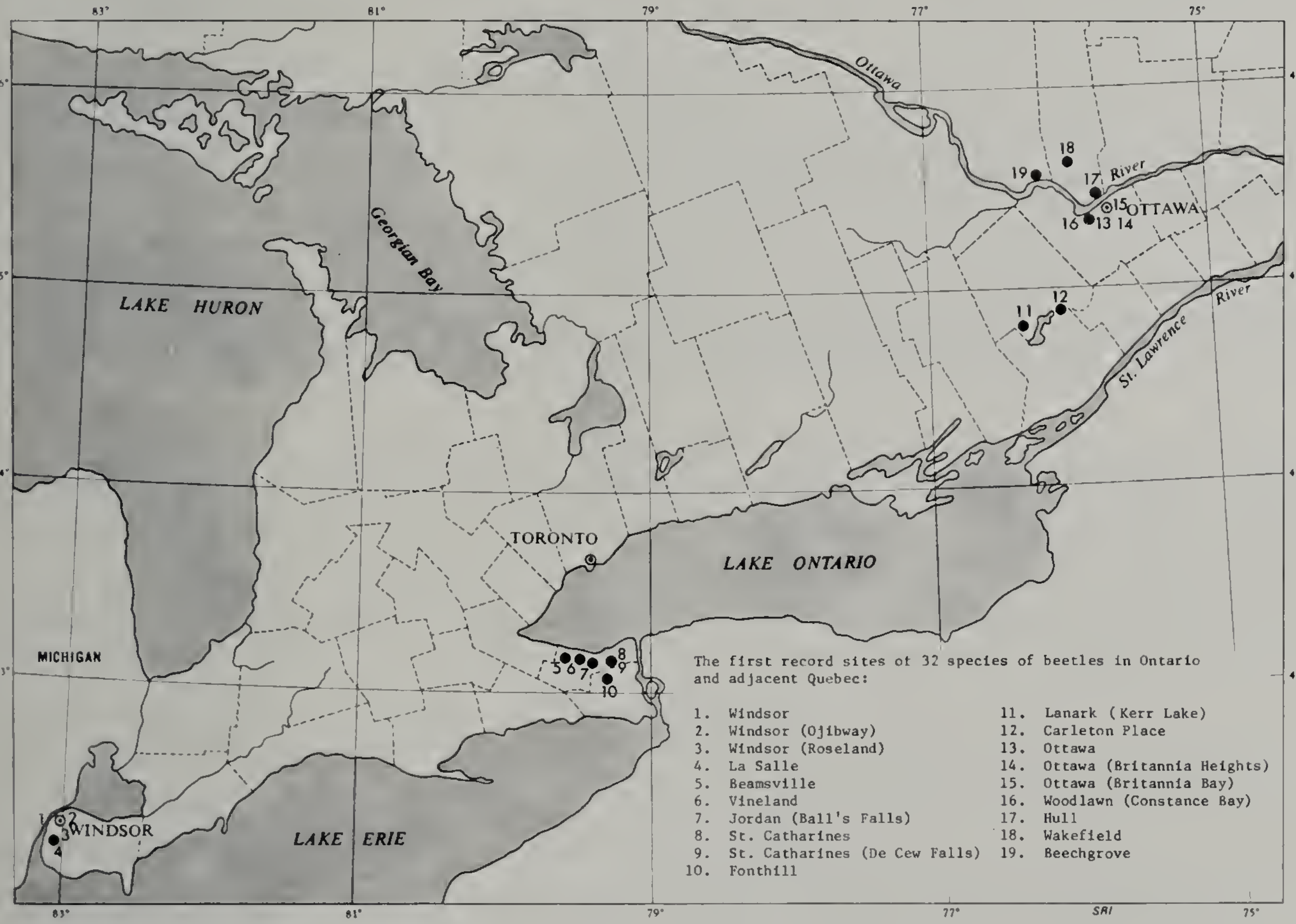
ABSTRACT

Records are presented for 33 species of beetles which are rare or localized in extreme southern Ontario and the Ottawa district. Families include Cicindelidae (1), Carabidae (3), Rhipiphoridae (1), Meloidae (2), Buprestidae (4), Coccinellidae (1), Scarabaeidae (5), Cerambycidae (10), Chrysomelidae (3), and Curculionidae (3).

In 1968 I published a summary article on coleopterous (and lepidopterous) collections in the Niagara Peninsula. During a period of 100 years only 4 resident coleopterists, of which I was the latest, have maintained extensive collections and published lists of their findings. My collection finally contained specimens not only from the Niagara Peninsula, but also from the Windsor area, and the Ottawa District. It has been incorporated in the Canadian National Collection for several years. Species in the following list have been selected because they are either unique or



The first record sites of 32 species of beetles in Ontario and adjacent Quebec:

1. Windsor
2. Windsor (Ojibway)
3. Windsor (Roseland)
4. La Salle
5. Beamsville
6. Vineland
7. Jordan (Ball's Falls)
8. St. Catharines
9. St. Catharines (De Cew Falls)
10. Fonthill
11. Lanark (Kerr Lake)
12. Carleton Place
13. Ottawa
14. Ottawa (Britannia Heights)
15. Ottawa (Britannia Bay)
16. Woodlawn (Constance Bay)
17. Hull
18. Wakefield
19. Beechgrove

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[1] The area embraced by a circle of 30-mile radius centered at the Parliament Buildings, Ottawa.

[2] I wish to thank Dr. Eugene Munroe, Ent. Res. Inst., Ottawa, for his helpful criticism.

rare Canadian records, or especially interesting records for Ontario and Quebec. None of these is represented in the earlier collectors' list (except an old, rare record of *Pseudostrangalia cruentata* Hald.).

The number of specimens first found for each record is indicated in parentheses after the collection year. Extremely local habitats are indicated in the text and on the map in the parentheses after the locality name. The family sequence follows that of the Leng (1920) catalogue.

CICINDELIDAE

Cicindela punctulata Oliv.—Beechgrove, Quebec, 1964 (14); the first authentic record for Quebec. During the following years, many specimens were seen and collected on the sandy loam soil in this area (Hicks, 1965).

CARABIDAE

Bembidium lacunarium Zimm.—St. Catharines (De Cew Falls), Ontario, 1957 (1): this is a unique record for Ontario (not Quebec, as recorded by Lindroth) and Canada, and has remained so. "It is an exclusively eastern ground beetle, ranging west to Minnesota and south to Texas" (Lindroth, 1963).

Harpalus indigens Csy.—Woodlawn (Constance Bay), Ontario, 1960 (1): this remains a unique record for Ontario. "Apparently rare, this species is restricted to a small area in the northeast". (Lindroth, 1968).

Calathus opaculus Lec.—Beechgrove, Quebec, 1966 (1): this specimen and another collected in the same year and in the same sandy loam area by H. Goulet are the first published records for Quebec. "It is apparently confined to sandy areas" (Lindroth, 1966).

RHIPIPHORIDAE

Macrosiagon limbatum (Fab.)—Windsor (Ojibway), Ontario, 1943 (2): the first Canadian record (Hicks, 1944).. The only other record is by Karl Stephen (in litt.) who collected this species at LaSalle, Ontario, about 5 years ago.

MELOIDAE

Zonitis bilineata Say—Beechgrove, Quebec, 1967 (1): a first and unique record (unpublished) for Quebec. It is rare in a few, widely scattered Ontario localities (Hicks, 1944, 1965).

Nemognatha vittigera Lec.—Windsor (Ojibway), Ontario, 1943 (1): this remains a unique Canadian record (Hicks, 1944).

BUPRESTIDAE

Acmaeodera tubulus (Fab.)—Windsor (Ojibway), Ontario, 1943 (2): still a unique Canadian record (Hicks, 1944).

Agrilus atricornis Fisher—Windsor (Ojibway), Ontario, 1943 (2): the first Canadian record. Other specimens were observed on the leaves of *Corylus americana* Walt. from which these were collected (Hicks, 1944).

Agrilus celti Knull & *Agrilus lecontei* Saunders—Carleton Place, Ontario, 1958 (many specimens of both species): this is the first and only record of each species in the Ottawa District. They have never been reported between this locality and extreme southern Ontario where a series of each had been collected from their host, hackberry (*Celtis occidentalis* L.)., at Point Pelee and Pelee Island (Hicks, 1960).

COCCINELLIDAE

Coccinella undecimpunctata L.—Ottawa, Ontario, 1960 (3): the first Ontario record of this European species. I first noticed these specimens in a local student's insect collection. They were collected in the immediate vicinity of his home. Additional specimens were found later in the same area and other local areas.

SCARABAEIDAE

Pleurophorus altanticus Cart.—Windsor (Ojibway), Ontario, 1944 (1): this remains the only Canadian record (Cartwright, 1948).

Trox striatus Melsh.—Beamsville, Ontario, 1941 (1): this remains a unique Canadian rarity (Hicks, 1947).

Phyllophaga rugosa (Melsh.)—Kerr Lake, Lanark County, Ontario, 1968 (6): this common species was well known in southern Ontario but only extended northeast as far as Marmora. This record extends the range eastward by 75 miles within 6 years.

Phyllophaga nitida (LeC.)—Vineland, Ontario, 1937 (1): a first Ontario record. It was collected by the author in a Japanese beetle scouting trap. This species has always been a rarity everywhere in Ontario and Quebec.

Popillia japonica Newn.—Ottawa (Britannia Heights), Ontario, 1964 (1): the first and only record of this economically important scarab in the Ottawa District is a living female collected on a raspberry leaf in the author's garden. Additional trapping was negative. This is about 400 miles from the nearest infestation at Toronto and further to extreme southern Ontario (e.g. Niagara Falls) where it first entered Canada in 1940.

CERAMBYCIDAE

Charisalia americana (Hald.)—Jordan (Ball's Falls), Ontario, 1942 (1): this remains as a unique record for Canada.

Pseudostrangalia cruentata Hald.—St. Catharines, Ontario, 1937 (1): the second record of a very rare species in Ontario. The first and only previous record was at Grimsby (Pettit, 1871). I collected another specimen at Vineland in 1941.

Typocerus sinuatus (Newn.)—Windsor (Ojibway), Ontario, 1943 (1): a unique Canadian record, collected by C. J. S. Fox (Hicks, 1944).

Oberea pruinosa Csy.—Windsor (Roseland), Ontario, 1944 (1): 6 more in the same locality, 1947; this habitat remains a unique Ontario record (Hicks, 1962).

Oberea appalachiana Csy.—Windsor, Ontario, 1943 (1): the first Canadian record; collected at only 2 other localities, Westport and Leamington, Ontario (Hicks, 1962).

Oberea exilis Csy.—Windsor (Ojibway), Ontario, 1946 (1): this remains a unique Canadian record (Hicks, 1962).

Oberea ocellata Hald.—Windsor (Roseland), Ontario, 1944 (1): this is the first and only Canadian record (Hicks, 1962).

Obera cylindricollis Csy.—Windsor (Roseland), Ontario, 1944 (1): 3 specimens were collected in the same locality in 1947; a unique Canadian record because of the localized habitat (Hicks, 1962).

Oberea oculaticollis (Say)—Windsor (Ojibway), Ontario, 1943 (1): the first Ontario record. In Canada, only 2 other specimens (Transcona, Manitoba) are known (Hicks, 1962).

Tetraopes quinquemaculatus Hald.—Windsor (Roseland), Ontario, 1944 (1): this remains a unique Canadian record (Hicks, 1945).

CHRYSOMELIDAE

Calligrapha rowena Knab—Wakefield, Quebec, 1948 (2): known for sereral years only from a single colony in the Ottawa District. However, it is known to have wide distribution in Ontario and Quebec.

Anoplitis philemon (Newn.)—St. Catharines (De Cew Falls), Ontario, 1939 (2): the first Ontario record associated with its host, wood nettle (*Laportea canadensis* (L.) Webb.). In 1960, several specimens were collected for the first time, after years of searching, in the Ottawa District at Ottawa (Britannia Heights) and at Hull, Quebec (Hicks, 1965).

Anoplitis sp.—Ottawa (Britannia Bay), Ontario, 1960 (4 pupae): this is the only evidence, after years of searching, that this leaf miner occurs in the Ottawa District. The pupae were found dead in 4 separate mined leaves of bittersweet (*Celastrus scandens* L.). It has been collected in the Niagara Peninsula where it is common on its host (Hicks, 1965).

Curculionidae

Anametis setosus Blatch.—La Salle, Ontario, 1946 (1): this remains a unique Canadian record (Hicks, 1947).

Brachyrhinus raucus Fab.—Fonthill, Ontario, 1936 (1): a first North American record. Later, in Ontario, this European species was reported in numbers from an area near Oakville and in hundreds at Ottawa (Britannia Heights). There is no recent evidence that a single beetle has survived the original large Ottawa colony (Hicks, 1947, 1948).

Cleonus piger (Scop.)—St. Catharines, Ontario, 1942 (1): the first Ontario record. This European species was later found to be established in several Ontario localities. In Quebec, a single specimen was first found in 1933 at Cascapedia, and large numbers were reported on their food plant, Canada thistle (*Cirsium arvense* (L.) Scop.) near Montreal in 1946 (Hicks, 1949).

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BRYOTHINUSA CHANI, A NEW SPECIES OF MARINE BEETLE FROM HONG KONG (COLEOPTERA: STAPHYLINIDAE)

IAN MOORE AND E. F. LEGNER[1]

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University of California, Riverside, 92502.

ABSTRACT

The genus *Bryothinusa* was previously known by a single species, *B. catalinae* Casey, from intertidal situations in California. The new species, *B. chani* Moore & Legner, was collected from intertidal mud flats in Hong Kong.

The genus *Bryothinusa* (Casey 1904) was based on a single species, *B. catalinae*, taken from the beach between high and low tide marks on Catalina Island, California. The original description was repeated by Fenyes (1920). Moore (1956) reported it from the seabeach at San Diego, California, redescribing the genus and species. A second species is described below.

Bryothinusa chani Moore & Legner, NEW SPECIES

Color dark piceous throughout except the appendages which are somewhat paler and the antennae uniformly dark ferrugineous. Integument very finely, densely reticulate and pubescent. Length 2mm.

Head: oval, about 1/4 wider than long, broadly concave in middle. Eyes large, occupying about 2/3 of the side of head, not interrupting the side margins of head. Antennae longer than head and pronotum, first and second segments about twice as long as wide, each about as long as third and fourth together, third through sixth of about equal length and width, longer than wide, narrower than second, seventh through tenth gradually wider, tenth about as wide as long, eleventh as long as ninth and tenth together, pointed at apex.

Pronotum: subrectangular, slightly wider and long, widest at anterior fifth; sides gently arcuate in apical half, thence nearly straight to the obtuse basal angles; base distinctly narrower than apex, slightly arcuate; apical margin nearly straight; disc strongly concave in center.

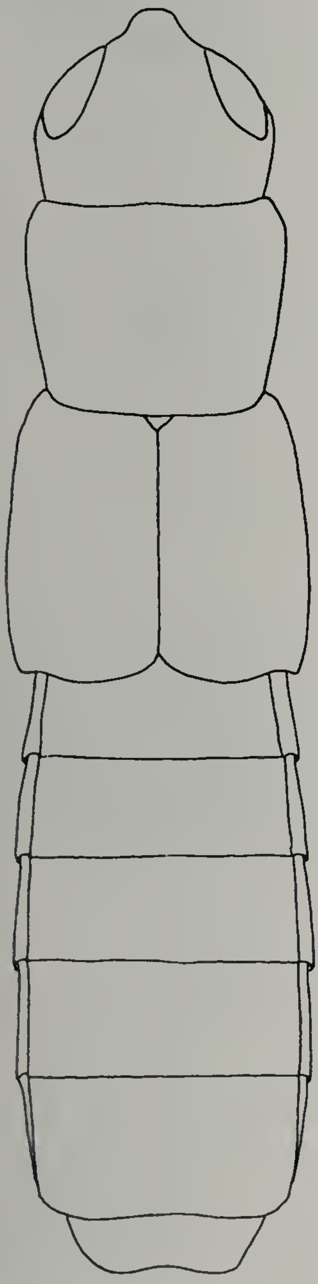

Fig. 1: Outline of dorsal view of body of *Bryothinusa chani* new species.

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[1] Staff Research Associate and Associate Professor of Biological Control, respectively.

Elytra: conjointly a little wider and a little longer than pronotum, inner apical angles narrowly but distinctly rounded.

Abdomen: nearly parallel sides, first segment shortest, the others each slightly longer than the preceding. First abdominal segment faintly impressed at base.

This species differs from *catalinae* in its darker color, its less elongate antennal segments and particularly in its much larger eyes.

SPECIMENS EXAMINED: *Holotype*: Shantin Mud Flats, Hong Kong, [California Academy of Sciences]. *Paratypes*: (10) 3 mounted on points, Shantin Mud Flats, Hong Kong, 7 mounted on 2 slides (3 on 1 slide and 4 on the other), Shantin Mud Flats, Hong Kong, 4-X-70. All specimens collected by Tai-din Chan who stated (personal communication), "Habitat: at low water, they wander on the surface of the mud flat and; at high tide they are under seawater by holding tightly to rocks and dead shells."

KEY TO THE SPECIES OF *Bryothinusa*

1. Eyes very small, occupying about 1/4 of the side of head .... *catalinae* Casey

1′. Eyes large, occupying about 2/3 of the side of head........................ ....*chani* Moore & Legner

In *Bryothinusa* and probably *Polypea*, marine genera of Aleocharinae, the inner and outer lobes of the maxilla are entirely corneous, the inner lobe with a row of teeth internally at the apex. This condition, very similar to that of *Myllaena*, is very unusual among the Staphylinidae.

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BEETLE TALK

The annual meeting of the Coleopterists Society will be held in conjunction with that of the Entomological Society of America, at Los Angeles, California (Nov. 28-Dec. 2, 1971). In addition to the regular meeting to be held during the informal conferences on Sunday (Nov. 28) eve, there will be a symposium on "Biology of Coleoptera". This will be held sometime during the regular ESA program. It will consist of 14 speakers and was organized by Dr. D. H. Kistner of Chico State College. —Ed.

(*continued from inside front cover*)

or counties listed. Dates are listed by day, month (in Roman numerals), and last 2 digits of the year. Listing of ecological data is encouraged. Location of specimens should be shown in brackets; if the data is extensive these should be abbreviated as shown and the abbreviations listed in the text.

Any article concerning Coleoptera will be considered. Descriptions of new taxa must contain keys (or be correlated with existing keys) and illustrations. All manuscripts should be typed on 8½x11" opaque white paper with 1 inch margins. They should be typed on one side only and double spaced throughout (including title, footnotes, tables, figure legends, and references). All scientific names should be underlined. Use the following order: title, author, author's address, abstract, body of text, references cited, and figures. All footnotes, tables, and figure legends should be provided on separate sheets and double spaced. Indicate approximate figure and table locations in pencil in the margin of the manuscript.

Abstracts should be a concise statement of the facts presented, not *that* they are presented (e.g. list names of organisms, not just that they were discussed or described as new). These abstracts are the key to how your article will be cited in the abstracting journals and should be carefully written.

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NOTICES

Notices to appear on this page are a free service to members and subscribers. Such copy will be limited to the back page, the older notices being moved up and replaced with the newest ones at the bottom. The editor reserves the right to reword such notices for brevity, consistency, and clarity.

STAPHYLINIDAE: Currently beginning study of taxonomy and morphology of larvae and adults of the Staphylinid subfamily Leptotyphlinae. Would like to borrow specimens in this group from North America primarily, but would welcome material from Central or South America. J. F. Cornell, Ass't Prof. of Biology. Appalachian State University, Boone, NC 28607.

TENEBRIONIDAE: Will exchange South American, Andean, and desert forms for any other groups of insects from Chile. Luis. D. Pena, G.P.O. Box 2974, Santiago, Chile.

CICINDELIDAE: Interested in obtaining specimens of **Cicindela trifasciata peruviana** from Peru and Ecuador. Will exchange for other Chilean species. Luis E. Pena, G.P.O. Box 2974, Santiago, Chile.

SCARABAEIDAE, CERAMBYCIDAE, LUCANIDAE: Goliath beetles, 14 different aberrations; 200 other species of beetles; for sale. Russell Dunn, Box 468, Sedona, AZ, 86336.

VIET NAM COLLECTION: Will exchange recently collected material from S.E. Asia for material from Southwestern U.S.A. Anyone wishing to determine material from this collection may keep the determined specimens. Bruce W. Miller, Dept. of Biological Sciences, Univ. of Nevada at Las Vegas, Los Vegas, NV 89109.

COLYDIIDAE: Revising the family for America north of Mexico. Wish to borrow material; will exchange for other Coleoptera. Karl H. Stephan, 3038 E. Eastland, Tucson, AZ 85716.

LIMNEBIIDAE: Revising the genus **Ochthebius** for North America. Desire material mounted or in alcohol. F. E. Wood, Dept. Ent., Univ. of Md., College Park, MD 20742.

Compiling check-list: Beetles of Clark Co., Nev. I would like to correspond with Coleopterists who have collected in southern Nevada. B. W. Miller, Dept. of Biol., Univ. of Nev. at Las Vegas, Las Vegas, NV 89109.

SWITZERLAND EXCHANGE: Interested in exchanging the following families: Cerambycidae, Carabidae, Lucanidae, Scarabaeidae (Cetoniinae, Goliathinae, Dynastinae). Ulysse Auberson, 6 les prés du lac, 1400 yverdon VD, Switzerland.

BEETLE MITES: I am engaged in research on Paramegistidae which are phoretic on insects. They are known from Carabidae (**Scarites & Harpalus**), Scarabaeidae, Passalidae (in Australia), millipedes, and ants. Will exchange or purchase these mites in alcohol. W. J. Voss, Texas Tech. College, Dept. of Biology, Lubbock, TX 79409.

SHARP & MUIR: THE COMPARATIVE ANATOMY OF THE MALE GENITAL TUBE IN COLEOPTERA. The classic 1912 monograph and 6 other papers by the same authors, 304 p., 43 pl., bound; $10.00. An essential book for all coleopterists. Entomological Society of America, 4603 Calvert Rd., College Park, MD 20740.

CICINDELIDAE: The following 3 papers are in preparation: "Cicindelidae of Quebec," "Food of cicindelids of the world," and "**Cicindela ancocisconensis** Harris." Label data, observations, and food habit notes would be appreciated. Andre Larochelle, College Bourget, C. P. 430, Rigaud, Quebec, Canada.

SCARABAEIDAE: Studying myrmecophilous and termitophilous Aphodiinae. Request loan of New World material especially. Will sort from general scarab collections or from light trap samples. Robert E. Woodruff, Fla. Dept. Agr., P. O. Box 1269, Gainesville, FL 32601.

HYDROPHILIDAE: Presently revising the genus **Hydrochus** from North, South, and Central America, including the Antilles. Request loan of any material from the Western Hemisphere. John L. Hellman, Ent. Dept., Univ. Maryland, College Park, MD 20742.

TENEBRIONIDAE: Building world-wide reference collection. Will purchase or exchange other Coleoptera. Especially desire immature stages. Kirby W. Brown, Peabody Museum, Yale Univ., New Haven, CT 06520.

HELODIDAE: Revising **Elodes**, need material from NW, W, SW, & S. Will pay postage. Prefer wet material, but mounted or dry OK. Desire larvae also. G. G. Kennen, 381 N. Central Ave., Ramsey, N.J. 07446.

CERAMBYCIDAE: Longicornes du Laos by Gressitt, Rondon, and Breuning. Pacific Insects Monograph 24, 1970, 651 p., 102 pl. (2 color), maps. Over 1000 species illustrated. $17.50 hard cover; $16.00 paper. Bishop Museum Press, Box 6037, Honolulu, HI 96818.

WORLD RESEARCH DIRECTORY: Richard L. Jacques and Dr. Ross H. Arnett, Jr. are preparing a world list of **current** research projects on Coleoptera. A volume will be published as a companion to the recently published "Directory of Coleoptera Collections." Anyone wishing to have a research project listed should write to R. L. Jacques, Dept. of Entomology, Purdue University, Lafayette, Indiana 47907. Forms will be provided.

CLEROIDEA: Conducting world-wide research on internal anatomy. Will exchange North and Central American groups for liquid (10% Formolin, etc.) preserved Cleroidea. Building world reference collection of Cleridae; will purchase or exchange. Ginter Ekis, Dept. Ent. & Econ. Zool., Rutgers, Univ., New Brunswick, N.J. 08903.

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THE COLEOPTERISTS BULLETIN

VOLUME 25, NUMBER 4 DECEMBER, 1971

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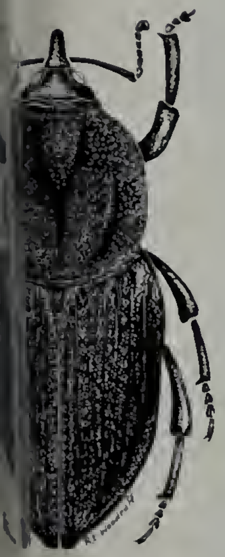

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THE COLEOPTERISTS BULLETIN

(Founded 1947 by Ross H. Arnett, Jr.)

The **Coleopterists Bulletin** is published quarterly, beginning in March, by the Coleopterists Society. All manuscripts, editorial questions, or business matters should be sent to the editor: Dr. Robert E. Woodruff, Florida Department of Agriculture, P.O. Box 1269, Gainesville, Florida 32601.

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The **Coleopterists Newsletter** is a mimeographed publication issued twice a year and mailed to all members of the Coleopterists Society regardless of whether they have a subscription to the **Coleopterists Bulletin.** News items and correspondence concerning the **Newsletter** should be sent to the editor: Dr. C. W. O'Brien, Div. Entomology, Texas Tech Univ., Lubbock, TX 79409.

Notice to Authors

Manuscripts will be considered from any authors, although those from members of the Coleopterists Society will be given priority. It is suggested that all prospective authors join the Society. All manuscripts should conform to instructions in the **Style Manual for Biological Journals** (2nd Ed.) prepared by the Committee on Form and Style of the Conference of Biological Editors, and published by the American Institute of Biological Sciences, 2000 P Street NW, Washington, D. C. 20063.

The following exceptions are noted: 1) All geographical names are to be spelled out, 2) use words, not symbols, for male and female, 3) use numerals throughout, except to begin a sentence, 4) entomology, -ical, -ist, etc. are to be abbreviated Ent. in literature citations.

Specimen label data should be listed in the following manner: MEXICO: State of Veracruz, Fortin de las Flores, 10-VIII-70, I. B. Jones, under bark of **Pinus moctezumae**, 7000ft. [USNM] (2). The number in parentheses indicates the number of specimens. Geographical names are listed in order with largest units first, with states, departments, provinces, parishes, and/

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(Mailed under second-class permit at Gainesville, Florida. Postmaster: send form 3579 to editorial office—Dr. R. E. Woodruff, P. O. Box 1269, Gainesville, FL 32601).

SYNOPSIS OF THE GENUS *OENOPION* (COLEOPTERA: TENEBRIONIDAE: COELOMETOPINI)

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ABSTRACT

Available information regarding the species of the genus *Oenopion* Champion is summarized. A new species, *adeptus*, is described, and the species *Iphthimus zopheroides* Horn is transferred into *Oenopion*. This generic change is supported by differences in the composition of the defensive secretions of the 2 genera, as well as morphological evidence.

Until the present time the genus *Oenopion* has included a single species, known only from the type specimen. The genus and species have remained practically unknown because of unavailability of specimens and have never received comprehensive treatment. This investigation has revealed a new species from northeastern Mexico and also has shown that *Iphthimus zopheroides* Horn should be included in the genus *Oenopion*.

The species of *Oenopion* occur in montane regions of Mexico and southwestern United States. Available information suggests that they are largely restricted to oak-woodland habitats, where the adults shelter beneath loose bark of tree snags.

GENUS *Oenopion* CHAMPION

Oenopion Champion, 1885:98. Type species, *Oenopion gibbosus* Champion, 1885, monobasic.

DESCRIPTION OF MALE: Body micropterous, robust, convex, about 2.5 times longer than wide, black.

Head: Cranium slightly more than half as wide as pronotum, widest between antennal insertions, slightly constricted behind eyes; epistoma weakly indented at epistomal sutures, angulately rounded anteriorly; gula broadly triangular, creased by transverse, anastamosing corrugations; eyes shallowly emarginated by supra-antennal ridge, dorsal and ventral lobes subequal; antennae extending nearly to middle of pronotum, segments gradually enlarged distally, forming very weak club; mentum small, trapezoidal, medially protuberant, exposing labial palps, ligula and maxillae; prementum small, quadrate.

Pronotum: convex, slightly broader than long, anterior angles broadly rounded, posterior angles angulate, with narrowly rounded apices; posterior pronotal margin broadly raised, lateral margins narrowly, weakly upturned, becoming obsolete anteriorly; procoxae separated by diameter of one coxal cavity.

Elytra: convex, strongly deflexed laterally, with epipleura ventrolateral in position; strongly, evenly, declivous posteriorly, tapering to acutely rounded apex; width at humeri subequal to that of pronotal base, maximum width slightly greater than maximal pronotal width; epipleura abruptly narrowed just behind humeri, gradually tapering posterad to elytral apex; epipleural ridge clearly defined throughout or obsolete anteriorly and posteriorly.

Mesosternum: anteriorly concave, receiving prosternal process; mesocoxae separated by slightly less than width of coxa; mesepisternum trapezoidal, anterior border arcuate, twice length of posterior border; mesepimeron trapezoidal, 1/4 length of mesepisternum. *Metasternum*: subequal in length to mesocoxal diameter; mesocoxal process truncate; metasternal groove 3/4 length of metasternum; antecoxal groove deeply incised, nearly attaining lateral metasternal margin; antecoxal piece gradually broadened laterally to about 4 times mesal breadth; *abdomen*: sternites convex, separated by deeply incised sutures; intercoxal process broad, rounded; sternites 1 to 3 subqual in length; fourth sternite 2/3 length of 3; fifth sternite nearly as long as third and fourth combined.

Legs: robust, moderately long; femora weakly clavate, widest about 2/3 distance from base, about 1/2 their length extending beyond lateral body margins, narrow strip of fine, yellow setae extending along inner 1/2 to 1/4 of femoral surface; tibiae subequal to femora in length, slightly, gradually enlarged distally, with 2 narrow, parallel lines of fine, yellow setae along distal 1/2 to 2/3 of inner surface, expanding to cover entire inner surface of apex; distal third of protibia moderately curved posteromesally, mesotibia weakly curved and metatibia straight; tarsae clothed ventrally with fine, yellow pubescence, reduced to 2 subparallel lines on distitarsus; tarsal claws 1/3 to 1/2 length of distitarsus.

Female: Similar to male but averaging about 15% larger; femora lacking elongate strip of fine, yellow setae; tibial setal lines usually slightly less extensive.

Diagnostic features: Distinguished from other genera of coelometopine tenebrionids except *Coelocnemis* by the 2 parallel lines of yellow setae on the inner tibial surface. Differs from *Coelocnemis* by the strip of yellow setae on the basal, inner surface of the femora (absent in *Coelocnemis*) and by the small, trapezoidal mentum (mentum large, oval, or hexagonal in *Coelocnemis*).

KEY TO THE SPECIES OF *Oenopion*

1. Strial punctures of elytra exceedingly coarse, more than 10 times diameter of interstrial punctures; frons very coarsely punctate .... *zopheroides* (Horn)
1′. Strial punctures of elytra fine, less than 5 times diameter of interstrial punctures; frons finely punctate 2

2. Prosternal process prominent; mesepimeron glabrous .... *gibbosus* Champion
2′. Prosternal process declivous; mesepimeron coarsely punctate .... *adeptus* new species

Oenopion gibbosus Champion

Oenopion gibbosus Champion, 1885:99 (Table 5, Fig. 8).

MALE: *Head*: Cranium finely, moderately densely punctate, becoming more coarsely so near epistomal suture and moderately punctato-rugose laterad of gula; epistoma strongly depressed below level of frons; deep, incised grooves bordering eye postero-dorsally and antero-ventrally.

Pronotum: disk highly convex, about 1.25 times broader than long, uniformly, finely punctate; lateral margins arcuate anteriorly, becoming nearly straight posteriorly; anterior corners broadly rounded, posterior corners obtusely angulate (105°); anterior border weakly biemarginate, posterior border weakly, convexly arcuate; hypomeron subglabrous, few fine punctures near dorsal margin; prosternum obsoletely rugose, with a few moderately coarse punctures medially; prosternal process prominent, rounded, densely, moderately coarsely punctate.

Elytra: about 1.5 times longer than broad, broadest near middle; strial punctures moderately coarse, separated by 2 to 4 times diameter; interstriae very finely sparsely punctate, weakly undulating, sparsely marked by fine, confused creases; epipleural ridge nearly obsolete, weakly defined anteriorly, but not reaching humerus, bordered dorsally by very coarse, irregular punctures; epipleuron glabrous, narrow, broadening slightly near humerus.

Mesosternum: coarsely punctato-rugose anteriorly, moderately rugose, finely, sparsely punctate posteriorly; mesepisternum coarsely, densely punctate on anterior 2/3, glabrous on posterior 1/3; mesepimeron glabrous; *metasternum*: finely, moderately densely punctate, very weakly rugose; metepisternum about 3.5 times longer than broad, coarsely, somewhat obsoletely punctate; *abdomen*: sternites finely, moderately densely punctate.

Legs: femora densely, moderately coarsely punctate, moderately rugose on basal, posterior surface; longitudinal strip of fine yellow setae extending along basal 1/5 of inner surface; parallel rows of setae extending along distal half of inner tibial surface.

Female: Unknown.

Holotype male: Cerro de Plumas, Vera Cruz, Mexico (see Selander and Vaurie 1962: 25), Hoege. Elytral length 13.3mm; greatest elytral width 9.0mm; pronotal length 5.9mm; greatest pronotal width 7.3mm; basal pronotal width 5.3mm. I am not aware of any specimens other than the holotype, which is deposited in the British Museum of Natural History.

Diagnosis: *O. gibbosus* is most similar to *O. adeptus* Doyen, differing by the prominent prosternal process (declivous in *adeptus*), the presence of the dorsal optic groove (absent in *adeptus*), the glabrous mesepimeron (coarsely punctate in *adeptus*) and the relatively short metepisternum.

Oenopion zopheroides (Horn), new combination
(Fig. 1)

Iphthimus zopheroides Horn, 1874:34.

MALE: *Head*: Cranium densely, very coarsely punctate, becoming reticulately punctate near epistomal suture and rugose ventrolaterally; epistoma strongly depressed below level of frons; deep, incised grooves bordering eye dorsally and anteroventrally.

Pronotum: disk convex, subrectangular, about 1.2 times broader than long, sparsely, finely punctate medially, becoming more coarsely so laterally; lateral margins subparallel in anterior 3/5, moderately, abruptly convergent posteriorly; anterior corners broadly rounded, approximately 90°; posterior corners obtuse or weakly everted and slightly acute; an-

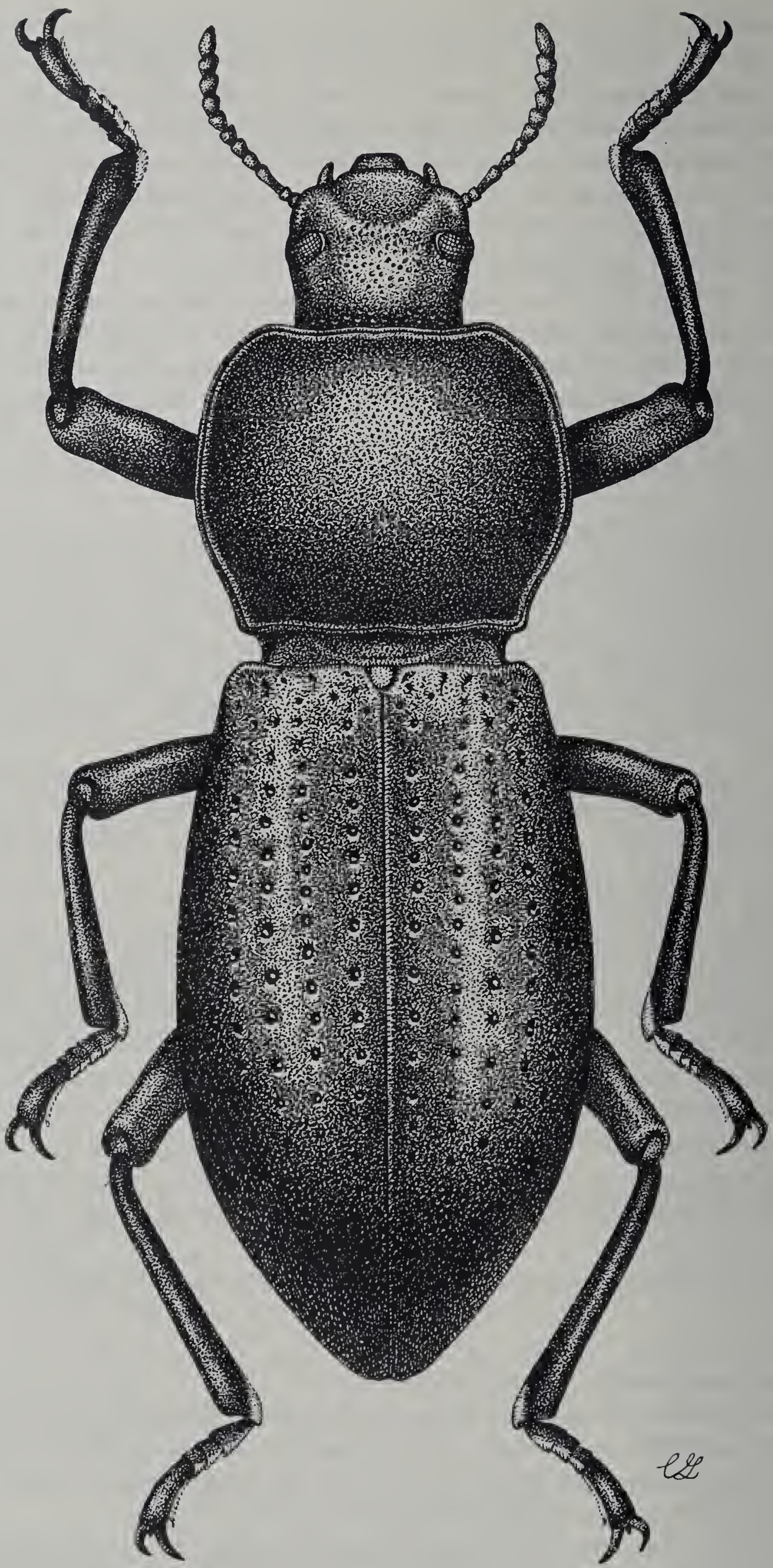

Fig. 1. Male of *O. zopheroides* (Horn).

terior border straight or very weakly emarginate; posterior border nearly straight; hypomeron sparsely, finely punctate near dorsal margin, otherwise glabrous; prosternum sparsely, coarsely punctate, sometimes weakly rugose medially; prosternal process declivous, posteriorly rounded, finely, sparsely punctate.

Elytra: about 1.75 times longer than broad, broadest behind middle; strial punctures exceedingly coarse, separated by 1 to 2 times puncture diameter; interstriae finely, sparsely punctate, weakly undulating medially

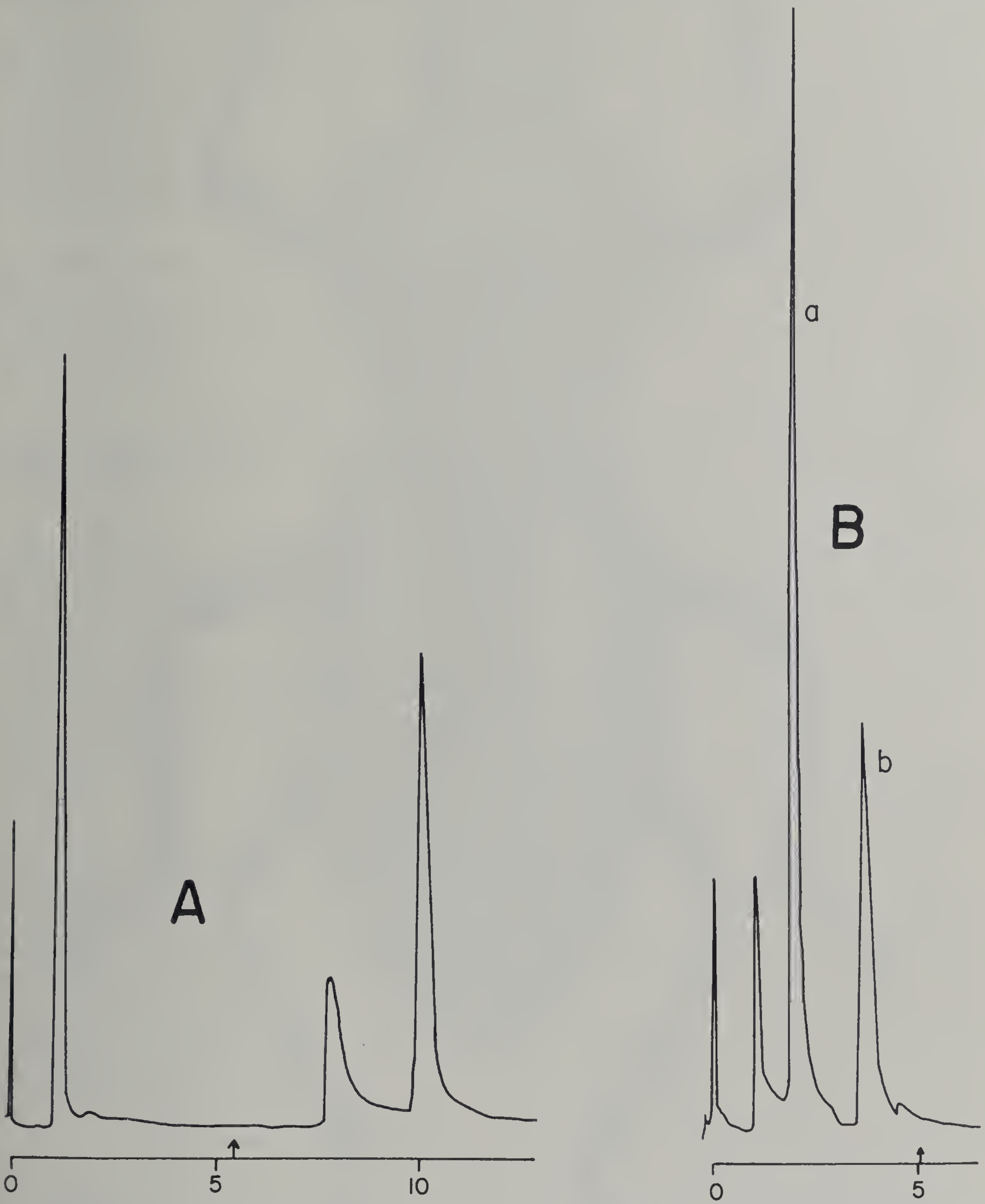

Fig. 2. Chromatographs of the defensive secretions of *Iphthimus* and *Oenopion*. A. Chromatograph of pooled secretions of 9 *I. lewisi* Horn. B. Chromatograph of pooled secretions of 3 *O. zopheroides* (Horn). Peaks *a* and *b* probably represent p-toluquinone and p-ethylquinone, respectively. Other components have not been identified. Results were obtained using a Varian Aerograph Model 1200-1 with a flame ionization detector, on 5% SE-30. Temperature programming was linear at 10°C per minute, from 75°C to 175°C. Arrows indicate onset of the temperature program.

to weakly rugose near humeri, sparsely marked by moderately coarse, confused creases; epipleural ridges clearly defined except near humerus; epipleuron narrow posteriorly, broadening abruptly near humerus, intersected by transverse creases, fine anteriorly, coarse posteriorly and accompanied by fine, dense punctation.

Mesosternum: punctato-rugose anteriorly, finely, sparsely punctate posteriorly; mesepisternum coarsely, moderately densely punctate on anterior 2/3, very coarsely, densely punctate on posterior 1/3; mesepimeron coarsely, sparsely and irregularly punctate; *metasternum*: sparsely set with moderate punctures mesally, these becoming coarse and dense laterally; metepisternum about 5 times longer than wide, coarsely, densely punctate; *abdomen:* sternites separated by weakly incised intersegmental sutures; anterior 3 sternites coarsely, moderately densely punctate; posterior 2 more finely punctate.

Legs: profemur coarsely, moderately densely punctate and weakly rugose; mesofemur and metafemur more finely, sparsely punctate, barely rugose; narrow, longitudinal strip of fine, yellow setae extending along basal 1/4 to 1/3 of inner femoral surface; parallel rows of yellow setae extending along distal 1/2 to 2/3 of inner tibial surface.

Female: Differs from male as stated in generic description.

Measurements: Elytral length 11.9 to 17.0mm; greatest elytral width 7.0 to 9.6mm; pronotal length 5.6 to 7.6mm; greatest pronotal width 6.5 to 9.0mm; basal pronotal width 5.2 to 6.9mm.

Type: Holotype male [Museum of Comparative Zoology, Harvard University]. No data is associated with the holotype, but Horn (1874:34) stated that it was probably collected in New Mexico. Holotype measurements: elytral length, 12.8mm; greatest elytral width 7.5mm; pronotal length 5.7mm; greatest pronotal width 6.9mm; basal pronotal width 5.2mm.

Diagnosis and discussion: *O. zopheroides* differs from the other 2 species in the genus by the extremely coarse strial punctures and the coarse cranial and ventral body punctation. It differs from *O. gibbosus* by the relatively elongate elytra.

The relatively small mentum, exposing the ligula and maxillae, and the unique setal patterning on the legs exclude this species from the genus *Iphthimus*. *Iphthimus* has a large, flattened mentum, concealing the mouthparts, a distal concentration of tibial setae, gradually becoming diffuse proximally, and lacks femoral setae. In addition, the defensive secretions of *I. lewisi* Horn and *O. zopheroides* show distinct differences in composition (fig. 2; see Doyen, 1970, for details). Conversely, the morphological characters, along with general body structure and dimensions, are shared with other species of the genus *Oenopion*. The composition of the defensive secretions of the other species of *Oenopion* is not known.

Additional material examined: Texas, Cameron Co., Brownsville, VI-1901, no collector [COR] (1); Texas, no data [MCZ] (2); Mexico, San Luis Potosi, Ciudad del Maiz, 5 mi. E., 25-VIII-1954, R. R. Dreisbach [USNM] (1); 8 mi. E., 26-VIII-1969, J. T. Doyen and J. A. Haddock, under loose bark *Quercus* sp. snags [California Insect Survey] (3).

Oenopion adeptus Doyen, NEW SPECIES

MALE: *Head*: Cranium finely, moderately densely punctate, becoming more coarsely so near epistomal suture and on genae, moderately rugose

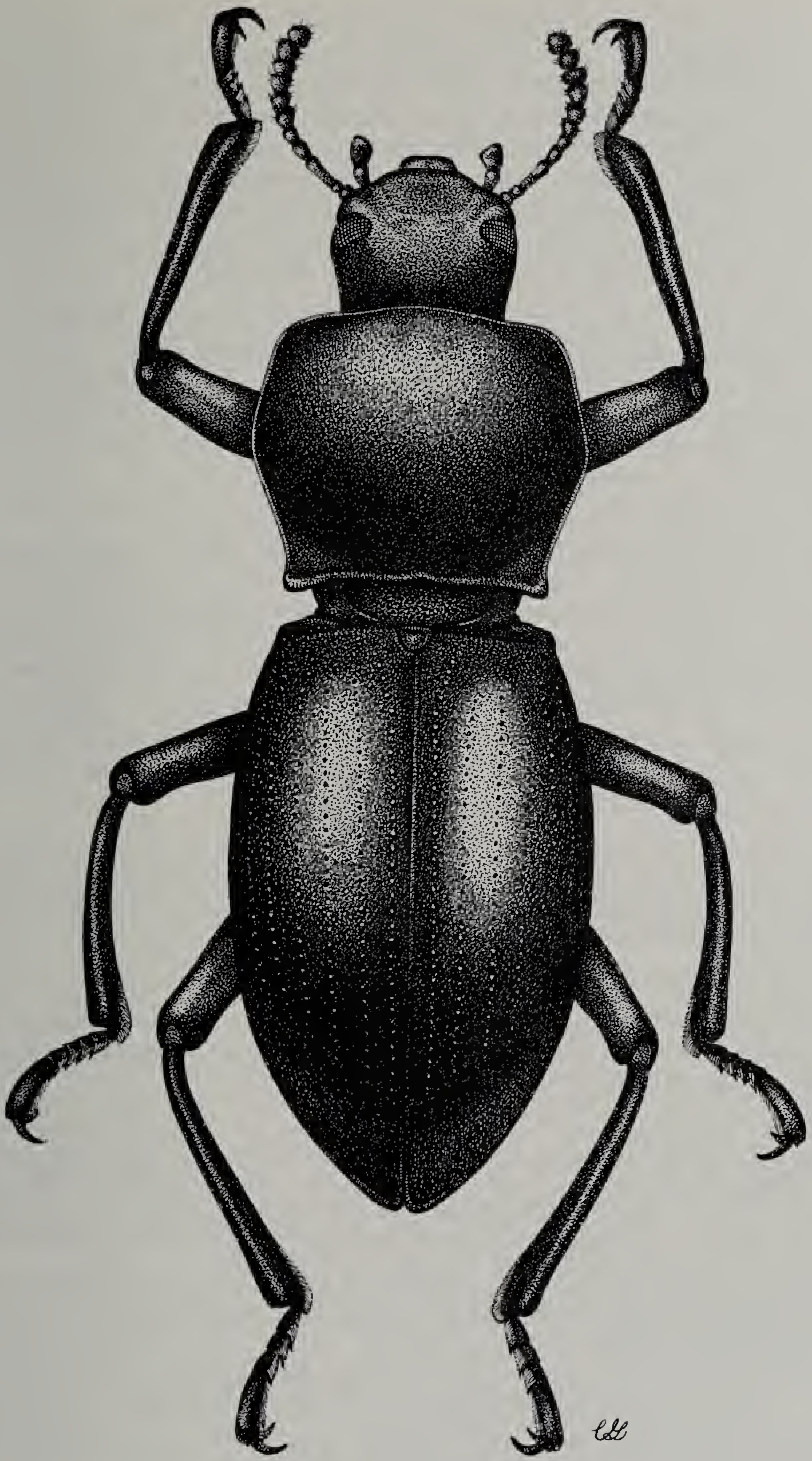

Fig. 3. Male of *O. adeptus* new species.

laterad of gula; epistoma not depressed below level of frons; deeply incised groove bordering eye anteroventrally.

Pronotum: disk convex, rounded, about 1.15 to 1.25 times broader than long, finely, sparsely punctate medially, becoming slightly more coarsely so laterally; lateral margins evenly arcuate anteriorly, becoming nearly straight in posterior half; anterior corners broadly, obtusely rounded, posterior corners slightly everted, acute (80°); anterior border nearly straight, posterior border very weakly bimarginate; hypomeron sparsely, moderately coarsely and obsoletely punctate dorsally, moderately rugose ventrally; prosternum strongly rugose with a few coarse punctures; prosternal process declivous, rounded posteriorly, finely, sparsely punctate.

Elytra: about 1.6 times longer than broad, broadest slightly behind middle; strial punctures moderately coarse, separated by 2 to 3 times diameter; interstriae very finely, sparsely punctate, sparsely marked by very fine, confused creases; epipleural ridge well defined throughout, forming prominent, obtusely rounded elytral humeri; epipleuron narrow posteriorly, abruptly broadened near humeri, glabrous or finely punctate and crossed by numerous fine, transverse creases, especially on posterior half.

Mesosternum: coarsely punctato-rugose anteriorly, finely, sparsely punctate posteriorly; mesepisternum coarsely, moderately densely punctate on anterior 2/3, coarsely, obsoletely punctate on posterior 1/3; mesepimeron coarsely, moderately densely and obsoletely punctate; *metasternum*: finely, moderately densely punctate; metepisternum about 5 times longer than broad, coarsely, moderately densely punctate; *abdomen*: sternites separated by deeply incised intersegmental sutures; anterior 3 sternites moderately densely, finely to moderately coarsely punctate; posterior 2 sternites moderately coarsely and densely punctate.

Legs: profemur moderately coarsely and densely punctate, weakly rugose on basal, posterior surface; longitudinal strip of fine yellow setae extending along basal 1/5 to 1/3 of inner surface; parallel rows of setae extending along distal 1/2 to 2/3 of inner tibial surface.

Female: Differs from male as stated in generic description.

Measurements: Elytral length 10.5 to 16.0mm; greatest elytral width 6.5 to 10.2mm; pronotal length 5.2 to 7.5mm; greatest pronotal width 6.0 to 9.3mm; basal pronotal width 4.7 to 7.2mm.

TYPES: *Holotype* male, Chipinque Mesa, nr. Monterrey, Nuevo Leon, Mexico, 5400′, 29-VII-1963, A. T. Howden; *allotype* female, same locality as holotype, 22-VII-1963, H. & A. Howden; 4 male, 5 female *paratypes*, same locality as holotype, 8/29-VII-1963, H. & A. Howden. The holotype and allotype in [Canadian National Collection, Ottawa]; paratypes in [Canadian National Collection] and [H. F. Howden].

Measurements of holotype: elytral length 14.6mm; greatest elytral width 9.4mm; pronotal length 7.4mm; greatest pronotal width 8.8mm; basal pronotal width, 6.5 mm.

Additional material examined: Mexico, Nuevo Leon, Apodaca, 5-VI-1956, I. Matezans [USNM] (1); 8-VI, I. Pedrero [USNM] (1); Chipinque Mesa, nr. Monterrey, 24/26-VIII-1960, H. F. Howden [CNC] (3); Liñares, 20 mi. W., 8-IX-1946, E. C. Van Dyke [CAS] (1); Villa de Santiago, L. Leal [USNM] (1); Puebla, Cacaloapan, 20-VIII-1963, F. D. Parker & L. A. Stange [UCD] (1).

DIAGNOSIS: *O. adeptus* is most similar to *O. gibbosus* Champion, differing in the characters stated in the diagnosis for the latter species.

ACKNOWLEDGMENTS

I am grateful to the following persons who made available specimens from the collections under their care: J. M. Campbell and H. F. Howden, Canadian National Museum, Ottawa [CNC]; J. F. Lawrence and P. J. Darlington, Museum of Comparative Zoology, Harvard University, Cambridge [MCZ]; H. B. Leech, California Academy of Sciences, San Francisco [CAS]; R. O. Schuster, University of California, Davis [UCD]; J. Shafrick, Cornell University, Ithaca [COR]; T. J. Spilman, United States National Museum, Washington, D. C. [USNM]; R. T. Thompson, and the authorities of the British Museum of Natural History, London, for permitting me to examine type material. The excellent illustrations of the adult beetles were done by Mrs. Celeste Green, to whom I am very thankful. The manuscript was read by J. A. Chemsak, who offered many helpful comments.

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BOOK REVIEW

Taxonomists glossary of genitalia in insects. Edited by S. L. Tuxen. 1970. Second edition. Munksgaard, Copenhagen (available in U.S. from S-H Service Agency, Inc., P. O. Box 2000, 260 Heights Rd., Darien, CT 06820). 359 p., 248 fig. Hard cover, $27.50.

The 1956 first edition of this title was a landmark in establishing some standardization and homologies for the complicated and voluminous terms applied to insect genitalia. This new edition contains 5400 terms which are defined. Sixty-six of the 248 figures are new, and 8 of the chapters have been completely rewritten. The authors comprise 35 of the top taxonomic specialists.

Snodgrass has said "The great structural diversity in the genitalia of insects is the delight of taxonomists and the despair of morphologists." Tuxen (p. 9) follows this quote appropriately: "May the present work help to heighten the delight and diminish the despair."

The chapter on Coleoptera (p. 80-88) is authored by C. H. Lindroth and Ernst Palmen. Unfortunately this chapter shows little improvement over the previous edition, and it provides a very cursory treatment of the wide variety of beetle genitalia. Obviously 10 figures and about 5 pages of text are insufficient, even for a general treatment of the largest and most diverse order of insects. It provides a useful introduction.

The most serious objection I have to this valuable reference is the unusually high price. Even the specialized references which would expect half the sales volume are priced much below this volume. The binding, although hard cardboard, is far from a quality cloth binding which should be expected at this high price. The volume should be in every library, but the cost will probably deter sales to individual taxonomists.—R. E. Woodruff.

BOOK REVIEW

John Banister and his natural history of Virginia, 1678-1692, by Joseph and Nesta Ewan. 1970. University of Illinois Press, Urbana, Ill. 61801. 485 p., 69 fig. Cloth, $15.00.

Although not well known to entomologists, John Banister was the first university trained naturalist to send specimens, drawings, and Latin descriptions of plants, insects, arachnids, and molluscs from North America to the leading naturalists in England. Unfortunately he met accidental death before his plans materialized to publish a "methodized" account of Virginia natural history. His catalogues and manuscripts, although surviving incompletely, shed considerable light on early natural history of North America.

The book is a masterpiece of biography, tracing nearly every facet of Banister's life: his training, associates, manuscripts, and extensive list of references. This quality of book is not possible except as a "labor of love." The most important section for coleopterists is Chapter 15:272-307 on insects and arachnids. Data are provided to show Banister's background in entomology and a list of books on the subject. His original manuscript entitled "Collectio insectorum" (1680) is in the British Museum.

Several Coleoptera are described sufficiently to associate them with their current scientific names: *Cicindela sexguttata* (Fab.)?, *Popilius disjunctus* (Ill.), *Alaus oculatus* (L.) or *A.myops* (Fab.), *Photuris pennsylvanicus,* and *Canthon pilularius* (L.) or *C. vigilans* (Lec.). In addition to these, there are several others that can be determined only to family: Cantharidae, Scarabaeidae, Cicindelidae, Elateridae, Lucanidae, and Lampyridae.

The account of *Canthon,* our common "tumble bug", is particularly indicative of the careful observations Banister made:

"Scarabeus niger pilularis. This is ye H(oly) Beetle in ye Tab(ula) Hieroglyph(ica) Laudina, mentioned by the Learnd Mr Gregory in his Preface. Here are multitudes of them in ye Summer time, rowling about their little globes of Corruption, which they mould up out of any Excremt: capable of formation: & so I suppose did those of Agypt, though Horus Apollo, to adde more reputation to the Dietie of his Father Apis, woud make ye world beleive they only made use of that of the Oxe. Nor do they, like his, in their motion, observe one constant position of ye Heavens, but tumble them indifferently toward any Quarter. So far indeed he is in ye Right, that when they turn them to ye West, they Look (ye Leading Ceremony will lose no credit, tho I say not Worship) Eastward; For they rowl them with their 'hind feet going Backward: Yet their progression at other times is not Retrograde.

"I have many times diligently observed these sedulous Animals yet never could percieve them to inject any thing into the dung, while they were making it up and as often inspected those rowleing pellets yet could perceive no alteration in the masse of matter through this their motion, till at length (when the weather began to grow coole, & this Insect not at all or rarely to be found) I met with one of those then deserted Balls, in the Center whereof lay a small white Grubbe which possibly might owe it's life to the before mention'd motion and in it's due time become such a Beetle. For I cannot thinke that Nature (who does nothing in vaine) instigates this Insect to take soe much paines to noe end . . ."—R. E. Woodruff.

NEW HOST AND LOCALITY RECORDS FOR *LEPTINUS TESTACEUS* MULLER IN WESTERN OREGON (COLEOPTERA: LEPTINIDAE)

CHRIS MASER AND EDWARD F. HOOVEN

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ABSTRACT

Leptinus testaceus Müller is recorded from 7 mammalian host species and 6 localities in western Oregon.

INTRODUCTION

Apparently little is known about *Leptinus testaceus* Müller since Lutz (1948) referred to it as "a European species", and Borror and DeLong (1964) cited it as a species which "occurs in the eastern states." Furthermore, it has been most frequently referred to in the literature as a beetle which inhabits the nests of, or is an ectoparasite on, "various" or "several" species of shrews, moles, mice, and other small mammals (Hatch 1957; Arnett 1960; Borror and DeLong 1964; and others).

RESULTS

We have collected *L. testaceus* from the following 7 mammals: Trowbridge shrew (*Sorex trowbridgii* Baird), Pacific shrew (*Sorex pacificus* Coues), Yaquina shrew (*Sorex yaquinae* Jackson), marsh shrew (*Sorex bendirii* (Merriam)), wandering shrew (*Sorex vagrans* Baird), shrew mole (*Neurotrichus gibbsii* (Baird)), and Oregon or creeping mole (*Microtus oregoni* (Bachman)). For details refer to the table.

Specimens were collected at the following Oregon locations (the numbers are used to refer to these locations in Table 1): 1) Coos Co., 1.75 mi. E Brandon, 100′; 2) Douglas Co., Bum Creek, Oxbow Burn, 20 mi. SW Crow, 300′; 3) Lane Co., Carson Creek, 15 mi. S Cottage Grove, 2000′; 4) Lane Co., 23 mi. SE Vida, 3000′; 5) Benton Co., Maxwell Creek, 3 mi. E King's Valley, 1000′; 6) Lincoln Co., 1 mi. NE Otis Junction, 240′.

DISCUSSION AND CONCLUSIONS

Müller is generally considered to be the author of the specific name *testaceus*. However, Hatch (1957:17) stated that Crotch is in fact the author and not Müller. We suggest that clarification of authorship is needed.

Gould and Beal (1952) reported *Sorex trowbridgii* as a host for *L. testaceus* in California. Thus far we have found the Trowbridge shrew to be its most common and widely distributed host.

It is of interest that 11 of 24 individual hosts (5 of 7 species) and 14 of 44 individual beetles collected over a period of more than 3 years came from 1 locality (1 mi. NE of Otis Junction, Lincoln Co.) in a single month. Whether conditions were particularly favorable for *L. testaceus* or whether it was merely chance collecting we do not know. The beetles might be more prevalent than is realized, but as the body heat of the dead host dissipates,

TABLE 1. MAMMALIAN HOST SPECIES OF *Leptinus testaceus* MÜLLER IN OREGON.

Host Mammal	Date of collection		Locale (see text)	beetles per host
Order Insectivora				
Family Soricidae				
Sorex trowbridgii Baird	3 March	1971	1	1
Sorex trowbridgii	22 Oct.	1970	2	2
Sorex trowbridgii	23 Oct.	1970	2	11
Sorex trowbridgii	26 Oct.	1970	2	2
Sorex trowbridgii	2 April	1968	4	2
Sorex trowbridgii	30 Sept.	1970	4	2
Sorex trowbridgii	29 March	1971	5	1
Sorex trowbridgii	7 April	1971	6	1
Sorex trowbridgii	8 April	1971	6	1
Sorex pacificus Coues	6 May	1971	1	1
Sorex yaquinae Jackson	4 April	1971	6	1
Sorex yaquinae	8 April	1971	6	1
Sorex yaquinae	10 April	1971	6	1
Sorex yaquinae	13 April	1971	6	1
Sorex yaquinae	15 April	1971	6	1
Sorex yaquinae	22 April	1971	6	2
Sorex bendirii (Merriam)	6 April	1970	1	4
Sorex vagrans Baird	4 April	1970	3	1
Sorex vagrans	27 May	1970	5	1
Sorex vagrans	15 April	1971	6	3
Family Talpidae				
Neürotrichus gibbsii (Baird)	15 April	1971	6	1
Order Rodentia				
Family Cricetidae				
Microtus oregoni (Bachman)	21 Oct.	1970	2	1
Microtus oregoni	21 Oct.	1970	4	1
Microtus oregoni	14 April	1971	6	1

the beetles may leave, thus accounting for the scarcity of specimens. Nevertheless, of 16 *Sorex yaquinae* collected, 6 harbored beetles, while only 9 of more than 100 *Sorex trowbridgii* from 5 localities (over approximately 3-1/2 years) yielded *L. testaceus.*

The only conclusion that we can draw from our knowledge of the host mammals is that in western Oregon the beetle appears to be restricted to mammalian hosts that make extensive use of burrows.

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THE LONGITUDINAL LINES ON BEETLE ELYTRA: A DEFINITION OF STRIA.

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Abstract

Considerable confusion exists in the literature and in the general interpretation of the term "stria". This terminology is discussed, and a more precise definition is provided.

What should coleopterists call the longitudinal lines on the elytra of a beetle? Does that seem too elementary a question? You can get different answers, some confusion, and some evasion when you ask various coleopterists. And you'll not find an adequate definition for the most commonly used term, stria, when you look at the literature.

I am speaking of the longitudinal lines (grooves, rows of punctures, etc.) on beetle elytra which are separated by the intervals (longitudinal areas). Most beetles have 9-11 lines, some have more, some less, and some, such as the Coccinellidae, have none. These lines are homologous, even though they may vary in number and though a line may be composed of simple punctures, punctures in depressions, punctures connected by a very shallow to very deep groove, setae, tubercles, a very fine inscribed line, a shallow to deep groove, or combinations of some of these. The morphological basis for these intervals and lines is well known. Briefly, the intervals are formed from the primary and secondary veins of the developing pupal forewings, and the longitudinal lines are external manifestations of rows of columellae, cuticular connections between the dorsal and ventral surfaces of the elytra; Doyen (1966:122) discussed this elytral morphology in *Tenebrio molitor* and listed background literature.

Coleopterists do not agree on a term for these longitudinal lines of the elytra. The word *stria* comes to mind, of course, and many (most?) coleopterists use *stria* in the broad or "generic" sense; i.e. whether the elytral lines are composed of punctures, grooves, setae, etc. However, other coleopterists use *stria* for elytral lines in the narrow or "specific" sense; i.e. only when such lines are grooves. Here are 3 examples of uses of *stria* and *striate* and the questions they raise: *elytra with striae* or *elytra striate* means either that the elytra have longitudinal lines of something or other or that the elytra have lines which are grooves; *elytra punctate-striate* or *elytra punctostriate* means either that the longitudinal lines are composed of punctures or that the lines are grooves with punctures; and *elytra with-*

out striae or *elytra not striate* means either that the longitudinal lines are not present or that the elytra do not have grooves. How, then, is a reader to know what an author means by *elytral stria*? He learns it from the general context of keys or descriptions. This should not be so. If these longitudinal lines on the elytra are indeed homologous, then they should have a generic term assigned to them, whether they are composed of punctures, grooves, setae, etc.

I contend that in English there is no adequately defined generic term for these lines. The word *stria,* certainly the first choice as a generic term because of past usage, is, however, limited in its definitions. In insect morphology *stria* means groove (=sulcus, furrow). Latin and English dictionaries define it in that way, but some give line or stripe as an alternate meaning. Torre-Bueno (1937) defined *stria* as groove, but also stated that *stria* is "in Coleoptera, a longitudinal depressed line or furrow, frequently punctured, extending from the base to the apex of the elytra." One constantly finds the words "depressed" or "furrow" when looking for definitions or elytral stria. Though these limiting words might be correct for a definition of *stria* in the usual entomological sense, they are not correct for a definition of *elytral stria* in the generic sense. If we can agree on this term *stria* for the elytral lines, all we need do is eliminate the words furrow, sulcus, groove, or depressed from its definition. We can change Torre-Bueno's definition to read "in Coleoptera, a longitudinal line extending from base to apex of elytra, frequently sulcate, punctate, setate, etc." *Stria* would still mean groove or sulcus when used for non-beetles or for any part of a beetle except the elytra.

The term *elytral stria* in the generic sense would not cause severe problems. When the striae are composed of punctures only, we would say *elytral striae punctate* or *elytra punctostriate;* when the striae are composed of only grooves, we would say *elytral striae grooved* or *elytral striae sulcate* or *elytra sulcostriate;* when the striae are composed of both punctures and grooves, we would say *elytral striae punctured and grooved* or *elytral striae punctate-sulcate* or *elytra sulcopunctostriate.* Many other examples could be given. However, the phrase *elytral stria striate* must not be used; *elytral stria sulcate* would be appropriate. This is obvious. Unfortunately the combination *stria sulcate* would sound redundant or even impossible to a grammarian, but we coleopterists will have to live with such criticism. What is the alternative? A new term could be coined, or a descriptive phrase, like elytral longitudinal line, could be used. I favor *elytral stria* as the correct generic term.

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A NEW SPECIES OF *HYPHANTUS* FROM BRAZIL (COLEOPTERA: CURCULIONIDAE: OTIORHYNCHINAE)

Patricia Vaurie

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Abstract

Hyphantus quadridens, a new species of flightless weevil, is described from the São Paulo region of Brazil.

The new species described below brings to 37 the total number of species of this genus of flightless South American weevils.

Hyphantus quadridens Vaurie, NEW SPECIES (Fig. 1-7)

Type, male, and paratype, female, from Serra Bocaina, São Jose Barreiro, São Paulo, Brazil, 1650 m., October to November, 1969, collected by Alvarenga and Seabra, in the collection of the American Museum of Natural History.

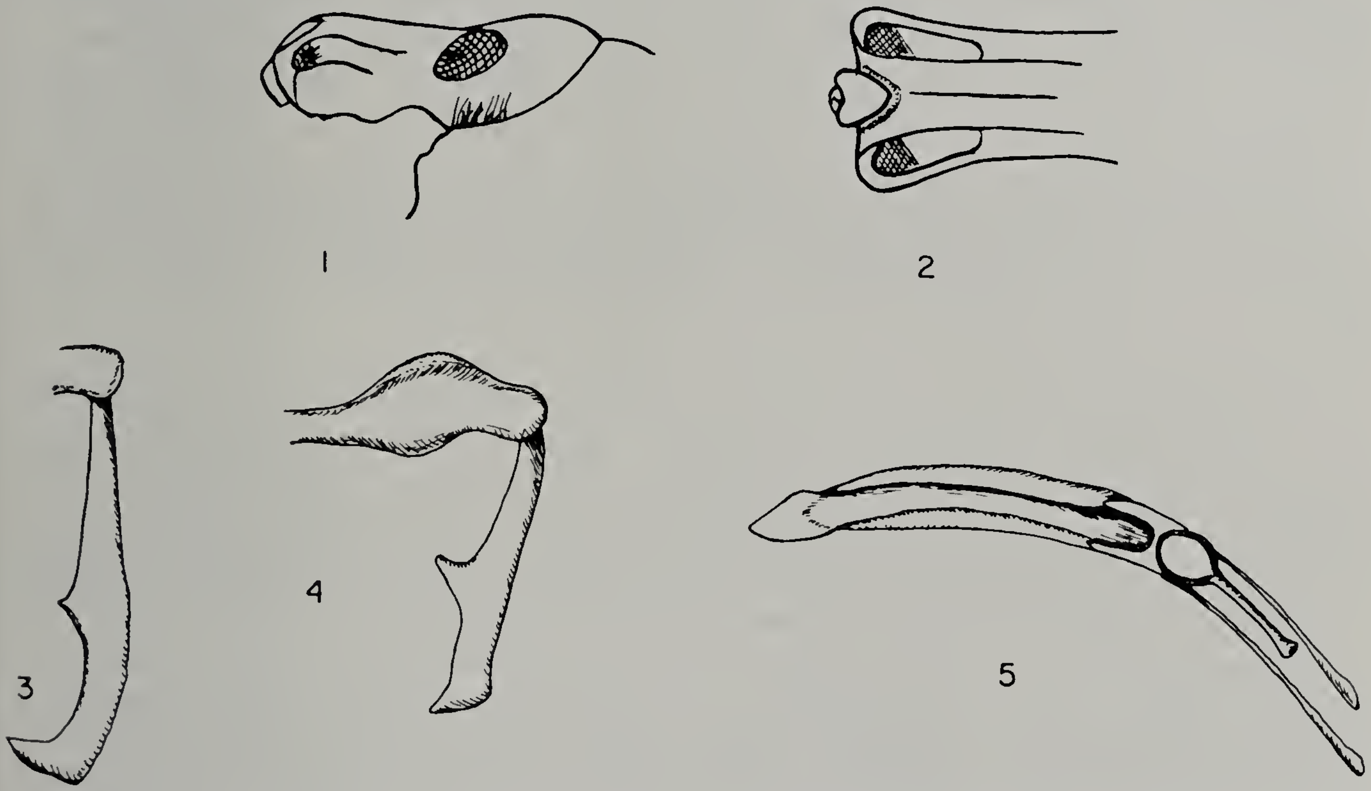

Fig. 1-6: *Hyphantus quadridens.* 1) head and beak of male. 2) V-shaped plaque at dorsal apex of beak. 3) front tibia of male. 4) middle tibia of male. 5) aedeagus (3/4 view) with tegmen in place and long apodemes.

Diagnosis: The combination of separately acuminate elytral apices, scaly dorsal surface, distinctly elevated V-shaped plaque (Fig. 2) at the apex of the beak, and the male characters separate this species from others. It belongs in the *maculifer* species-group and is dorsally very similar to *hypercalus* and *maculifer* of that group. It differs further from them in

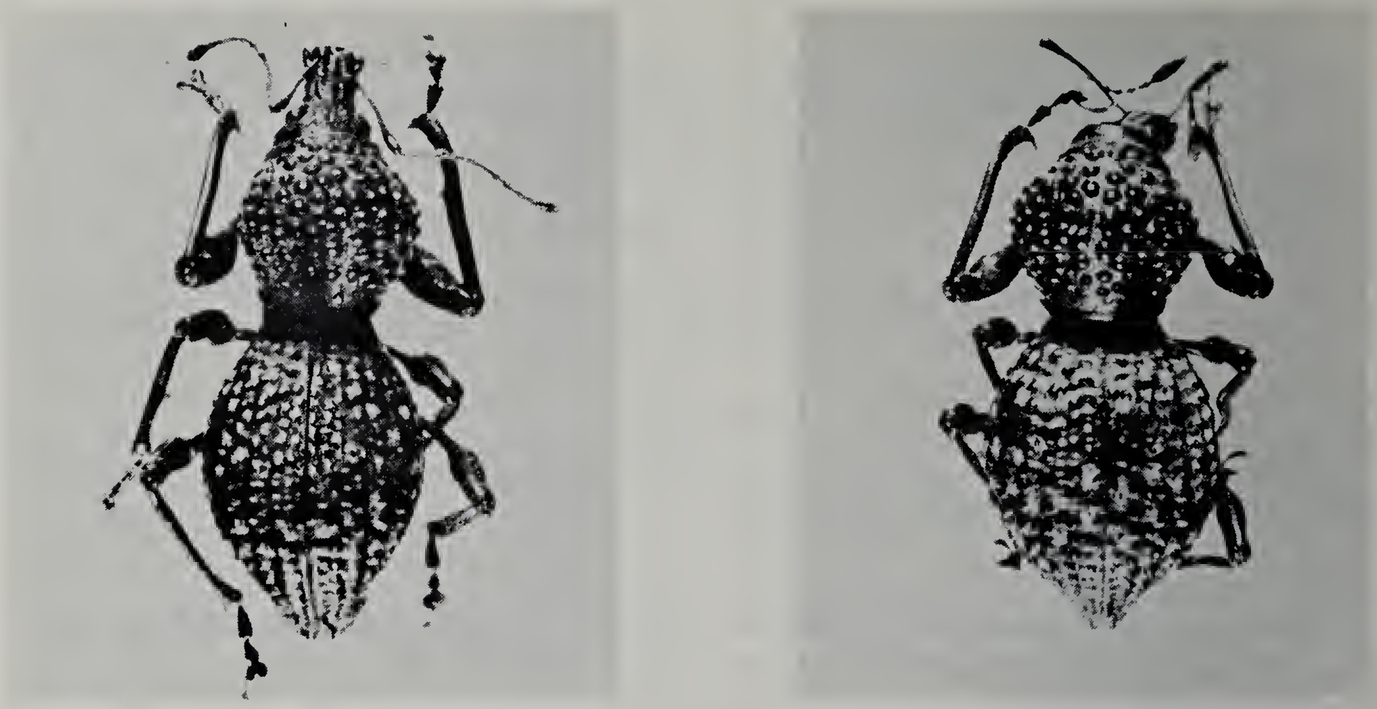
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Fig. 6, 7: *Hyphantus quadridens.* 6) male. 7) female.

the male by having a tooth on both front and middle tibiae (Fig. 3, 4), but no tooth under the beak, and in the female by having the middle and hind tibiae straight, not sinuate.

Type, male: length 9mm. Beak strongly tricarinate; apical V-shaped plate slightly concave within; base transversely sulcate; ventrally (Fig. 1) at middle slightly tumid. Pronotum convex, as wide as long, about ½ length of elytra, with yellow scales in apical third, on median line, and in 2 lateral patches; sides strongly arcuate; tubercles convex, round, slightly separated, in number about 12 across widest part of disc. Elytra convex, slightly wider than pronotum, strongly narrowed to separately acuminate, triangular apices, with from 5 to 7 round clusters of yellow scales on each strial row; tubercles subcontiguous, slightly smaller and much less convex than those of pronotum.

Front femur bulbous, with spine on inner margin near apex; front tibia on inner margin with broad, triangular tooth in front of middle, thence tibia emarginate to inner apical mucro; middle tibia toothed at middle; hind tibia not toothed, straight. Abdomen with segments 2 to 4 convex; all segments separated by deep impressions; apical segment broadly rounded, at least as long as segments 3 and 4 combined.

Aedeagus (Fig. 5) with apex of median lobe triangular and acuminate; dorsal orifice long; apodemes nearly as long as median lobe; sternite 9 (spiculum gastrale) not forked; tegmen (ring with parameres) present.

Remarks: The female paratype is 8mm long and agrees with the description of the male except for the following: ventral side of beak in profile is virtually straight, not tumid; elytra shorter and wider (Fig. 6, 7), less than twice the pronotal length; tibiae not toothed within, front tibiae slightly sinuous and curving inward to apical mucro; and apex of abdomen rather acuminate.

A tooth or spine on 1 of the tibiae of the male is not a unique character in the genus, but *quadridens* is unique in having a tooth on 2 of the tibiae. Other species also have dehiscent elytra, as *H. brevicauda, dehiscens,* and *verrucifer.* These species are in a different species-group (the *baccifer* group) and are characterized chiefly by having the dorsal apex of the beak smooth and the body with some hairs or setae, but no scales.

Two additional species (21 specimens) were collected by Alvarenga and Seabra at the same locality and on the same date as *quadridens*. One of these (*carinatus* Vaurie) is in the *baccifer* species-group; the other is *bracteatus* Vaurie of the *maculifer* species-group which agrees with *quadridens* in having a V-shaped nasal plaque and body scales, but the scales are dense and overlapping, not in clusters, and the aedeagus and secondary sexual characters of the male differ. The aedeagus of *quadridens* is similar to that of *hypercalus* Vaurie.

In my key (Vaurie 1963:252) the new species can be placed ahead of couplet 3 and thus we avoid the question of the visibility or density of the elytral scales. The couplet will then read:

Elytra with apices separately acuminate; elytra and pronotum with scattered lines or clusters of yellow scales; male with both front and middle tibiae submedially toothed on inner margin .... *quadridens*
Elytra with apices contiguous or very slightly separated; elytra and pronotum scaled or not; male with either 1 tibia toothed, or no tibiae toothed 3

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AN ADVENTITIOUS SPECIMEN OF *CHLAENIUS NAEVIGER* MOR. IN SEATTLE (COLEOPTERA: CARABIDAE)

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A single male specimen of this species was taken along the Seattle, Washington waterfront in April 1971 by Mr. Don Frechin. It was found alive in an empty wine bottle and has been kindly identified for us by Dr. P. J. Darlington of the Harvard Museum of Comparative Zoology.

The beetle has a distinct chlaeniid facies, but is distinguished from Nearctic species by a large irregular transversely quadrate testaceous spot at about the apical fourth of each elytron extending from interval 4 to interval 8. Mouthparts and appendages testaceous; head and pronotum strongly viridescent with strong aeneous reflections; elytra very obscurely viridescent; venter black; pronotum strongly punctate and slightly longer than broad; length 13 mm. According to Csiki (Coleop. Cat. 115, 1931: 963) *C. naeviger* Mor. is native to northern China and Japan. It is one of a number of Asiatic species with maculate elytra.

This find establishes a record, in case the species is later found to have become a member of the North American fauna. More important, it shows that the introduction of foreign species is still going on. A single male is insufficient to establish the species. Even the progeny of the majority of species represented by gravid females probably do not survive. But, every now and then, they do, a fact to which the many Old World species in our fauna bear witness.

BOOK REVIEW

A Revision of the Clytrinae of North America North of the Isthmus of Panama (Coleoptera: Chrysomelidae). Andrew R. Moldenke. 1970. 310 p. Stanford University Press. $5.00 (paper).

This very ambitious work covers about 135 species and numerous subspecies. During the research over 25,000 museum specimens were examined, and about the same number was observed in the field. Keys are presented for the tribes, for the genera of each tribe, and for the species and subspecies of each genus. For the species and subspecies the synonymy, literature references, descriptions, maps, and illustrations are given. A new genus, some new species, and numerous new subspecies are described. A useful feature is inclusion of species from northern portions of South America and not known from the area covered, but which could conceivably be found there. This work is recommended for those interested in Chrysomelidae.

The table of contents is novel and very useful in that it also serves as an index. The genera are arranged alphabetically, and beneath each genus are listed alphabetically all the species-group names included in the treatment of that genus. Unfortunately the table appears to have been thrown together hastily. In the first 35 species entries I find 18 errors. In fact, most of the names designated in the table of contents as "n. syn." are actually treated in the work as subspecies names. Other errors among the 18 include erroneous page references, designation of a name as "n. comb." when new status applies, and an erroneous author citation.

Effective writing would have added to the usefulness of the introductory portion. The statement of taxonomic philosophy (pages 5 to 8) seems overblown and does not contribute to the paper. The body of the text has generally been more carefully composed.

The keys usually work well but users will find some descriptions imprecise, and there is even an absence of direct comparability between contrasting couplets. The meaning of some of the key characters is obscure at best; an example (see pages 45, 46, and 57) is "Epaulette showy" versus "Epaulette not showy".

On page 211 in reference to figures 51 and 52 for *Smaragdina aviculus* is found "the illustrations of male individuals are simply conjectural". This is indefensible.

I have checked USNM material loaned for this study with the data given in the work and find a distressing frequency of discrepancies. There are cases where specimens are supposed to be in this collection but are not, and other cases where specimens bear an identification label including the data "cited in monograph" but are not. Also, specimens properly belonging to other museums have been sent in the returned material to this museum.

Requirements for high quality of graduate training in taxonomy include selection of a problem of suitable size, the teaching of effective writing, detailed presentation of the methods of taxonomy, and emphasis on the importance of care in amassing data and checking and presenting the written record. This study shows the results of deficiencies in these areas. The too numerous faults may be attributable to the fact that it was simply too large for a thesis problem with its requisite time limit. However, many of the defects could have been weeded out by close checking of the work by a graduate faculty committee and/or editorial examination before it was rushed into print.—Richard E. White, Systematic Entomology Laboratory, Agricultural Research Service, U. S. Department of Agriculture, c/o U. S. National Museum, Washington, D. C. 20560.

OBSERVATIONS ON THE BIOLOGIES OF *ENOCLERUS ABDOMINALIS* (CHEVROLAT) AND *ENOCLERUS OPIFEX* (GORHAM) (COLEOPTERA: CLERIDAE)[1]

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Abstract

Observations on the feeding, mating, and ovipositional activities of *Enoclerus abdominalis* (Chevr.) and *Enoclerus opifex* (Gorham) are discussed. The association of *E. opifex* with *Dasylirion texanum* Scheele, and of both clerids with *Yucca thompsoniana* Trel. and with a weevil (*Peltophorus polymitus* Boh.) are reported.

Although both *Enoclerus abdominalis* (Chevr.) and *Enoclerus opifex* (Gorham) have been known from the United States for many years, information concerning their biologies has been limited to short statements by Wickham and Wolcott (1912) and Böving and Champlain (1920). For this reason the following notes, although incomplete, are presented.

Information concerning *E. abdominalis* was gathered on 28 July 1969, 4 miles west of Marathon, Brewster County, Texas; from rearing specimens collected 7 June 1970, loc. cit.; and both *E. abdominalis* and *E. opifex* were observed on 7-13 May 1971, 14 miles west of Comstock, Val Verde County, Texas.

Distribution: *E. abdominalis* has been recorded from several Mexican locations (Vaurie 1952) and from the south central and southwestern United States (Corporaal 1950). *E. opifex* was described from Guanguato, Mexico; at that time Guatemala and Nicaragua were included in its range (Gorham 1882). Its occurrence in the United States is limited to the Trans-Pecos and Big Bend regions of Texas and adjacent portions of New Mexico (Wolcott 1911).

Plant Associations: *E. abdominalis* has been recorded from the blossoms of yucca. *E. opifex* has been recorded from yucca and agave. During the course of this study, *E. abdominalis* was observed on *Yucca thompsoniana* Trel. *E. opifex* was observed on *Y. thompsoniana* and *Dasylirion texanum* Scheele (commonly known as sotol).

Enoclerus abdominalis (Chevrolat)

Adult Activity: During the day, adults of this species can be observed on the leaves, stalks, or blossoms of yucca. Nights are usually passed on the lower part of the stalk or adjacent leaves. Adults have been observed occasionally spending the night on the flower heads.

Mating occurs on the stalk and flowers. Two instances of mating were observed in their entirety. During each instance the male vibrated his an-

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[1] Published with the approval of the Director of the Agricultural Experiment Station as Research Paper No. 887.

tennae rapidly before contacting the female, while exploring her position, and during copulation. In each case the female ceased other activity during copulation. One copulation lasted 4 minutes and the other lasted 3.25 minutes.

DEVELOPMENTAL STAGES: Larvae develop within the plant stalk and feed on the larvae of a weevil, *Peltophorus polymitus* Boh. Mature larvae spend the winter in old feeding galleries of the host where they pupate the following spring.

Enoclerus opifex (Gorham)

DAILY ACTIVITY: The daily activities of *E. opifex* are closely associated with certain desert plants including sotol, agave, and yucca. The larvae live within the stalk of these plants, preying upon phytophagous insect larvae found there. During the day adults can be found on the stalk, blossoms, and leaves. They commonly spend the night at the base of the stalk or on adjacent leaves. Occasionally they stay on the upper stalk or blossoms.

MATING ACTIVITY: Mating activity occurs on the plant and can be observed during all daylight hours. One mating was observed in its entirety. Both participants were present on the plant when the observation began. The male crawled to where the female was feeding on a bud. He vibrated his antennae rapidly and constantly while approaching, then explored the position of the female with his antennae. The female vibrated her antennae periodically while copulating and continued to feed intermittently during the entire time. After disengaging his aedeagus, the male flew to an adjacent plant. The female continued to feed on the plant where copulation had occurred.

ADULT FEEDING BEHAVIOR: Although several hours were spent watching adults, no evidence of predation was observed. Rather, *E. opifex* appeared to feed primarily on the tissues and fluids of the host plant. Individuals were often observed chewing on the tender tissues of unopened buds and feeding on the ensuing exudate. *E. opifex* also exhibits a feeding association with a large coreid, *Acanthocephala granulosa* (Dall.), that commonly feeds on the terminal portion of sotol and yucca stalks. The clerid stations itself near a feeding coreid. When the bug withdraws its proboscis and moves to another feeding site, the clerid approaches the abandoned feeding site and proceeds to feed on the exudate accumulating at the wound. The same phenomenon was observed in association with *P. polymitus.*

OVIPOSITIONAL ACTIVITY: The relationship of *E. opifex* to the weevil apparently goes beyond opportunistic feeding. On one occasion a few minutes before dark, a female weevil was observed ovipositing on a yucca stalk about 3 decimeters above its base. As the weevil oviposited, it was approached by an *E. opifex* female which explored the weevil with her antennae and then waited motionless except for continual antennal vibrations. As soon as the weevil withdrew her ovipositor and moved away, the female clerid explored the ovipositional wound. She first fed on exudate from the wound, then stationed her abdomen over the site and proceeded to deposit a single egg. The egg was placed at the edge of the wound. After ovipositing, the clerid moved to the base of the plant where she spent the night. From these observations it seems likely that larvae of *E. opifex* prey upon immature stages of the weevil.

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HELOPHORUS BREVIPALPIS BEDEL IN NORTH AMERICA (COLEOPTERA: HYDROPHILIDAE)

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ABSTRACT

North American records for the Old World *Helophorus brevipalpis* Bedel are confirmed by 16 female specimens from Logan Canyon, Utah.

In a previous publication (Angus 1970a) I showed that the beetle recorded in North America as *H. brevipalpis* Bedel by McCorkle (1965, 1967) was not that species, but *H. orientalis* Motschulsky. Subsequently (Angus 1970b) I reported a genuine *H. brevipalpis* from Logan Canyon, Utah, among material sent in tubes of alcohol to the British Museum (Natural History) in London.

I have since seen the following North American *H. brevipalpis*: 11 females from Spring Hollow, Logan; and Logan, collected between March and July from 1944 to 1967, sent by Utah State University; and 4 females taken at Logan 6-VII-55, sent from the Canadian National Insect Collection, Ottawa. These, with the original British Museum specimen, give a total of 16 specimens, all from Logan and all female.*

The American specimens have the pronotal granulation slightly more rounded than in Siberian specimens, more as in European material. They are easily separated from *H. orientalis* by the form of the maxillary palpi and, when cleaned, by the pronotum (c.f. Angus 1970a:134, Fig. 2, 11-14, 16 and 21-24).

It is possible that H. brevipalpis is an introduction into North America, but if so it seems rather surprising that it should occur in this area of Utah. However, L. A. Mound (personal communication) tells me that he has seen 2 specimens of the European *Megathrips lativentris* (Heeger) (Thysanoptera), both female, from Logan, so it may be that this is an area into which European species are introduced. At any rate, *H. brevipalpis* has occurred there for nearly 30 years, and apparently not spread. The Canadian material included *H. orientalis*, but no *brevipalpis*, from Randolph, Utah, and the specimens from Utah State University included a number of species from several Utah localities.

The apparent absence of male *H. brevipalpis* in America could be the result of only females having been introduced. Thus L. A. Mound (personal communication) stated that in a number of cases where Thysanoptera have been introduced into new areas, only females are found, and in some now ubiquitous species the restricted distribution of the males may be taken as an indication of the original range of the species. However, it is very curious that these female *H. brevipalpis* should occur in the one area where both sexes of *H. orientalis* are known (Angus 1970a; McCorkle 1967).

Addendum: I have seen 8 additional female specimens collected at Logan, Utah in 1971.

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A NEW SPECIES OF SCULPTURED, CONIFER-INHABITING *CHRYSOBOTHRIS* FROM NEVADA AND CALIFORNIA (COLEOPTERA: BUPRESTIDAE)

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Abstract

Chrysobothris barri n. sp., occurring from central Nevada to southern California, is described, and considerable detail is given to variation and comparison with the closely related *C. ludificata* Horn.

During the early summer of 1960, a series of what was thought to be *Chrysobothris ludificata* Horn was collected from pinyon pine slash in the Shoshone Mountains of central Nevada. Subsequently, it was found to represent a new species. Since it falls into a group in which the members are often extremely difficult to define, special attention is given to details of description, variation, and comparison.

I am indebted to the following individuals for loan of their specimens which pertained to this study: W. F. Barr (University of Idaho), F. M. Beer, D. S. Verity and G. C. Walters.

Chrysobothris barri Westcott, NEW SPECIES
(Fig. 1-5)

Male: Moderately elongate, slightly convex above, black, moderately shining; front of head bright green with light coppery reflections which increase slightly on vertex; pronotum with slight bronzy reflections in depressed areas, purplish bronze reflections at sides; elytra copperish and greenish bronze in depressed areas; ventral surface black with strong purplish, coppery, and bronzy-green reflections.

Head with a pair of smooth, rounded callosities on middle of front and a well developed, broad, smooth longitudinal carina on vertex; surface with rather coarse, irregular, shallow, almost confluent punctures, rather densely clothed with moderately long, decumbent hairs; clypeus broadly, rather deeply, angularly emarginate at middle, truncate laterally; antennae with dorsal surface of segments 1-4 almost entirely bright green, becoming entirely purplish-brownish on segments 7-11, strongly serrate from fourth segment, third segment scarcely serrate, twice as long as second segment, about one and three-quarters times longer than fourth segment, slightly shorter than fourth and fifth combined, segments 7-10 one and one-half to two times wider than long, ultimate segment one and one-third times wider than long, outer margins broadly rounded, of 5-6 more narrowly rounded, 4 subtriangular.

Pronotum one and four-fifths times wider than long, widest at basal third, slightly wider at base than apex; sides irregularly subparallel, strongly converging apically and weakly so at base; lateral margin as seen from below side moderately wide, wider basally, weakly arcuate, strongly

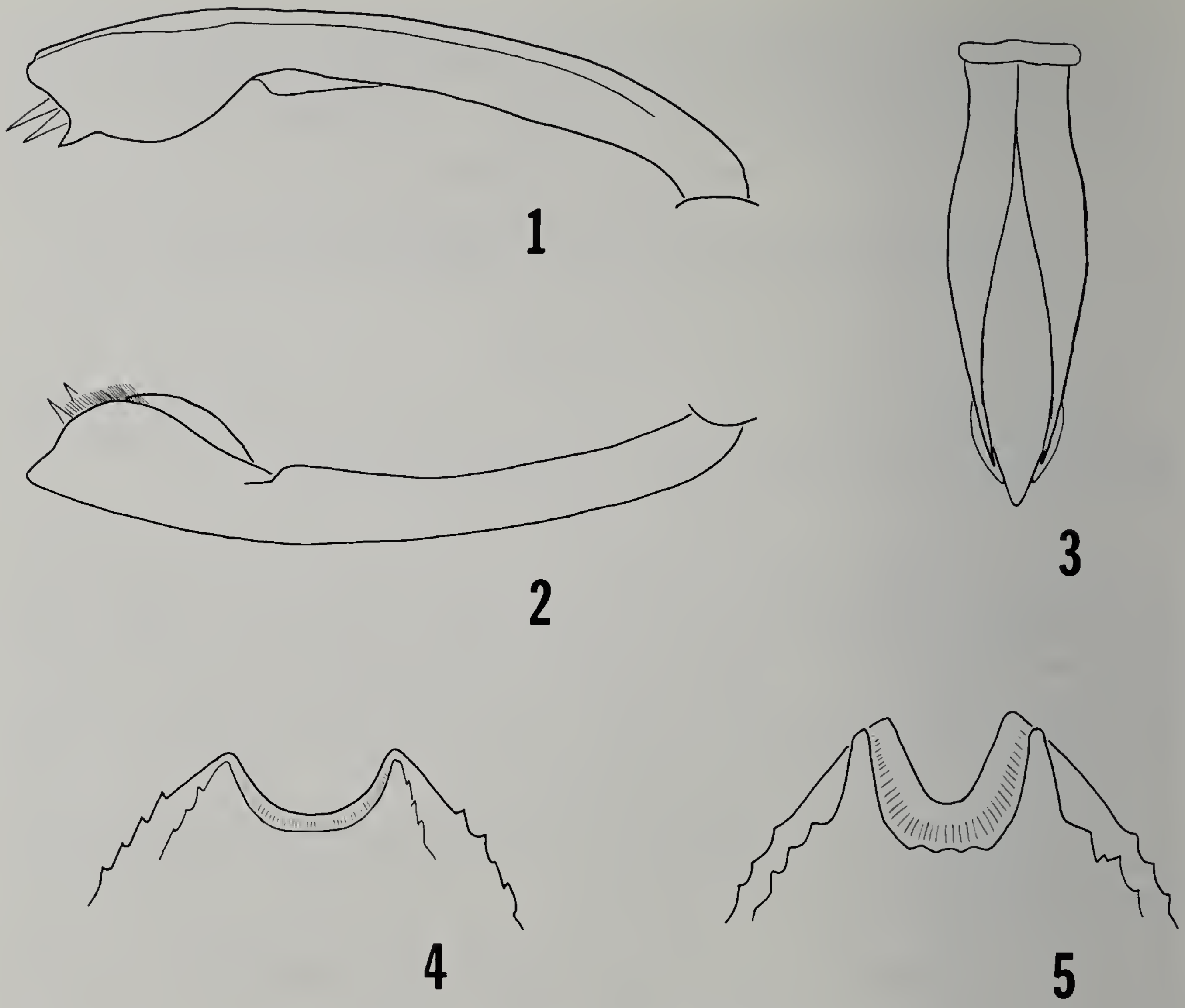

Fig. 1-5: *Chrysobothris barri* n. sp. 1) protibia of male, rear aspect. 2) same, front aspect. 3) male genitalia, dorsal aspect. 4) last visible abdominal sternite of male.) 5) same of female.

so on apical seventh; anterior margin broadly, very shallowly emarginate, subtruncate medially; posterior margin with median lobe very slightly produced and truncate; surface irregular, with a pair of wide, smooth callosities on either side of middle which are joined apically and basally, delimiting a moderately narrow, deeply punctate, longitudinally carinate depression, and on each side irregularly joined near middle with a wide submarginal longitudinal callosity which is interrupted by heavily punctured areas and delimited mesad by moderately indicated subbasal and subapical depressions, antero-laterad by a broader, more distinct depression, densely, coarsely, sometimes confluently punctate, rather inconspicuously clothed with a few short to moderately long, suberect to subrecumbent, white hairs along sides and extreme base which are more numerous and conspicuous on hind angles.

Elytra distinctly wider than pronotum, nearly twice as long as wide; base of each elytron quite semicircularly rounded; sides subparallel from about basal eighth to slightly behind middle, then gradually, arcuately rounded to separately, narrowly rounded apices; lateral margins very feebly serrate from just behind middle, serrations becoming more conspicuous slightly before apex, never strong; basal depressions deep, rounded; humeral depressions shallower, oblique; each elytron with 4 more or less prominent, smooth, longitudinal costae which adjoin and/or merge variably with numerous, irregular, smooth callosities, intervening areas densely, moderately coarsely punctate; sutural costa entire, straight, extending from just behind base to apex, strongly elevated posteriorly; discal costa subparallel to sutural costa, extending from base to near apex where it joins sublateral costa on right elytron, narrowly separated on left elytron, interrupted in depressed punctured area in front of middle; humeral costa apparently arising from sublateral costa shortly behind umbone, appearing diverted or broken just beyond middle, joining discal costa at apical fourth; sublateral costa entire, somewhat irregular, extending from umbone practically to apex, beyond association with discal costa; vestiture consisting of very short, extremely inconspicuous, suberect hairs which are practically nonexistent on disc, very sparsely placed on narrow basal portion, along sides and between sutural margin and costa, becoming more frequent near apex.

Prosternum coarsely, moderately densely punctate at middle, rather sparsely clothed with short to moderately long whitish hairs, which are longer and more densely placed laterally; anterior margin broadly, shallowly rounded on middle, with a broad, very well developed median lobe.

Abdomen beneath scarcely convex to somewhat flattened at middle, rather finely, sparsely punctate at middle, punctures more densely placed laterally and larger on sides of first sternite, pubescence short, inconspicuous at middle, becoming much longer and more dense towards sides; lateral callosities smooth, well developed on second to fourth visible sternites, less prominent on first and last; last visible sternite with lateral margins rather feebly serrate, entire near apex, hind margin broadly, almost semicircularly emarginate at apex, submarginal ridge very feebly developed.

Legs with femora and tibiae with coppery-purplish-bluish reflections, tarsi purplish-bluish, outer surface of profemora with strong green reflections; profemur with a well developed, obtusely triangular tooth which is irregularly, feebly denticulate on outer margin; protibia moderately arcuate, inner margin slightly expanded at apical third then abruptly, rather deeply constricted, subapical dilation broadly, rather evenly rounded to just before apex; mesotibia about as arcuate as protibia, slightly expanded apically, inner surface with a small, narrow, broadly rounded, longitudinal dilation on middle at apical fourth; metatibia straight.

Length, 11.5mm; width, 4.6mm.

FEMALE: Differs from male as follows: Front of head, antennal segments 1-3, and outer surface of profemora predominantly purplish-coppery; abdomen beneath more convex, particularly laterally, last visible sternite with a rather well developed, strongly serrate submarginal ridge which is rather narrowly, semicircularly emarginate at apex, hind margin with a deep, U-shaped emargination; pro- and mesotibiae unmodified.

Length, 12.2mm; width, 4.9mm.

HOLOTYPE MALE AND ALLOTYPE FEMALE (California Academy of Sciences) and 17 male and 6 female paratypes from NEVADA: Shoshone Mts., Ichthyosaur St. Mon., 21-24-VI-1960, R. L. Westcott, *Pinus monophylla* slash, 7000 ft. Additional paratypes, all from CALIFORNIA: 1 male, Panamint Mts., Wild Rose Can., 22-VI-1958; 1 male, San Bernardino

Co., 2 mi NE Wrightwood, 20-III-1960, pinyon pine, D. S. Verity; 1 male, 6 females, Riverside Co., Pinyon Flat, 19-IV-1959, 1-V-1960, *Pinus monophylla*, D. S. Verity, R. L. Westcott; 5 males, 3 females, Wrightwood, 10-VII-1966, 3-VI-1967, on pine; 20-V-1967, beating pine; 1-VII-1967, *Pinus monophylla,* G. C. Walters. Paratypes deposited in the collections of Los Angeles County Museum of Natural History, U. S. National Museum, W. F. Barr, F. M. Beer, J. M. Davidson, G. H. Nelson, D. S. Verity, G. C. Walters and the author. Most, if not all, of the specimens from Pinyon Flat, California, were taken on stumps of recently cut trees. Since all but 1 were females, this may be at least partially indicative of their oviposition habits.

VARIATION: This species exhibits considerable variation, yet due to its sculptured configuration, it appears quite uniform to the eye. However, most California specimens appear less finely sculptured than those from the type locality. In males the front of the head may exhibit strong coppery reflections and the vertex is usually coppery, whereas in females the front may be narrowly bordered by green. Coppery reflections almost always predominate on the depressed, punctured areas of the elytra. The third antennal segment varies from scarcely to not at all serrate. The apical segments are slightly variable in width, appearing more chunky in most females from Nevada. They vary from 1.5 to (rarely) just over 2 times wider than long, except for the ultimate segment which is usually less than 1.5 times wider than long. The basal antennal segments are usually bright green, but often there is a coppery overcast, particularly on the scape. One specimen examined had the metallic coloration distinctly indicated on segments 7 and 8.

The configuration of the pronotal surface is quite uniform. Variation exists in the shape and extent of the callosities, particularly the lateral ones, and in the depth of depressions. The median longitudinal carina, though usually clearly defined, is vaguely indicated in a few specimens. It appeared obsolete or was absent on most of the specimens examined from California.

The very nature of the elytral sculpturing creates numerous minor differences in configuration, which exist not only between individuals but between elytra on the same specimen. This phenomenon, in my observation, is true for all members of this species group. The greatest and most readily definable variation occurs in the costae. The sutural costa is always entire, but occasionally terminates slightly before the elytral apex. The discal costa may be entire or widely interrupted and, apically, irregular. The humeral costa is clearly defined basally, but is often irregular and occasionally obliterated apically. The sublateral costa is rarely narrowly interrupted and/or poorly defined apically, may or may not adjoin with the discal costa at the apical fourth of the elytron and occasionally ends in the sutural costa.

All specimens available for study have a very well developed median lobe on the prosternum, which exhibits slight variation in width and is usually slightly sinuate. This character is highly variable, to the point of being either present or absent, in some species of this group.

The abdominal callosities are usually well developed, but may be punctured or not prominent, particularly on the first and last visible sternites, and the side margins of the latter vary from irregularly, feebly serrate to rather evenly, strongly serrate. In the female, the sides of the U-shaped emargination at the apex of the hind margin varies from parallel to convergent. The submarginal ridge is moderately to well developed and indistinctly to distinctly serrate, while in the male this ridge is usually weakly developed, occasionally moderately developed and serrate. In the female the area between the bases of the emarginations of the submarginal ridge and hind margin varies from declivous to vertical.

The rounded protibial dilation of the male is somewhat variable in development and contour and may end well back of, or extend to, the tibial apex. In the former case it resembles that of *C. ludificata.* The mesotibial dilation may be scarcely evident on some specimens. Specimens range in length from 10.5 to 12.5mm.

COMPARISON: *Chrysobothris barri* clearly is most closely related to *C. ludificata* and will run to that species in Fisher's (1942) key. From the series at hand of 48 males of the latter species, from Arizona, Nevada, and Utah, all males of *C. barri* were separable by the color of the front of the head, which varies from bright green with light coppery reflections to (rarely) predominantly bright coppery, rather than predominantly brassy or brassy green as found in *C. ludificata.* The metallic coloration of the antennae is rarely evident beyond the seventh segment (usually not prominent beyond the sixth), never extending past the eighth (except for 1 California specimen, on which it is vaguely indicated on the ninth segment). The last 2 segments are never metallic. In *C. ludificata* the brassy colorations always extends at least to the ninth segment and is strongly evident to there, although the outer segments may become quite coppery. The last 2 segments always bear metallic, mostly coppery, reflections which are usually strongly indicated. The outer antennal segments of *C. ludificata* are broader and more widely separated and though the width/length ratio is only slightly higher than in *C. barri,* it appears much greater, particularly on the last 3 segments. Remaining doubts as to identity would be dispelled quickly upon examining the genitalia, in which the parameres of *C. ludificata* are much more strongly constricted beyond the middle, becoming parallel along the apical fifth. In most cases the shape of the protibial dilation will serve well to separate the 2 species.

Except for the (apparently) allopatric distribution of *C. barri* and *C. ludificata,* the females of these species are rather difficult to separate. Based upon material examined and a literature review, their nearest proximity is 160 miles (between the type locality of *C. barri* and Mendha, Lincoln County, Nevada). Records of *C. ludificata* from California appear to be in error; some may refer to *C. barri.* Thirty-five females of *C. ludificata* were studied from the same localities as the males. The outer antennal segments of *C. ludificata* are wider than those of most specimens of *C. barri* seen from the type locality. However, specimens of the latter from southern California have the antennal segments as wide or wider. The submarginal ridge of *C. barri* usually terminates in a well developed, often thorn-like tooth, which is distinctly larger (in all but 1 specimen studied) than any of the other serrations. This is usually not the case with *C. ludificata,* though it may be difficult to ascertain without a series of specimens. The only uniformly reliable anatomical character found for separation is the nature of the front margin of the prosternum. In *C. barri* it is distinctly, usually rather strongly, arcuate at middle, bearing a well developed lobe which is .10 to .13mm long in all but 2 specimens studied. The median lobes of these specimens (length 10 and 10.5mm) measured .08mm. The median lobe in *C. ludificata* is highly variable, ranging from absent to .07mm long, the upper limit being represented by 2 specimens measuring 13 and 13.5mm. It is feebly developed (.03mm or less) in 54% of the specimens studied. Fisher (1942) did not mention any variability in this character, simply redescribing the type ". . . without a distinct median lobe." Fortunately this caused no confusion in his key, due to the (then) unique antennal characteristic of *C. ludificata.* However, it should be mentioned that the outer antennal segments are considerably wider in the male.

I take great pleasure in naming this beetle after Dr. W. F. Barr, who has done so much to further my interests and endeavors in the field of entomology.

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ECOLOGICAL NOTES ON *CYMINDIS NEGLECTA* HALDEMAN (COLEOPTERA: CARABIDAE)

ANDRE LAROCHELLE

C. P. 1000, Bourget College, Rigaud, Quebec, Canada

In Quebec, *Cymindis neglecta* is found under hardwood trees and bushes, on moderately moist, often gravelly ground, among dead leaves. Other associated carabids are: *Agonum retractum* LeConte, *Anisodactylus lugubris* Dejean, *Olisthopus parmatus* Say, and *Pterostichus pensylvanicus* LeConte. Lindroth (1969, Ground-beetles of Canada and Alaska, 6:945-1192) does not record the ecology of this species.

ON SOME AFRICAN *STENUS* FROM THE U.S. NATIONAL MUSEUM OF NATURAL HISTORY (COLEOPTERA: STAPHYLINIDAE), 96. CONTRIBUTION TO THE KNOWLEDGE OF STENINAE

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ABSTRACT

African *Stenus* from the U.S. National Museum of Natural History are studied and cited; 5 taxa are described as new: *Stenus obconicus malawianus, Stenus spangleri, Stenus callens, Stenus spinicollis,* and *Stenus cooki.*

The African *Stenus* fauna is one of the most interesting in the world because of the geological history of the continent. About 230 taxa in this genus were known previously from Africa and Madagascar.

Dr. Paul J. Spangler was kind enough to send to me for study the African *Stenus* in the National Museum of Natural History [NMNH]. This paper provides a list of that material and the descriptions of 5 new taxa.

Stenus mendicus separatus L. Benick

1 female, Dunbrody (SOUTH AFRICA, Cape Colony): (loc. typ.).

This is the only subspecies of the polytypic species *mendicus* Erichson that is known from the Cape Colony. The specimen in the NMNH should be regarded as a paratype because it belongs to the original series.

Stenus cameratus cameratus L. Benick

1 female, Heluan, Fenyes; 1 female, Pyramides, 10 Aug. 1933, coll. Alfieri; 1 female, Route de Suez, jerne tour, 15 Oct. 1926, coll. Alfieri.

This species is widely distributed throughout Africa; it is known from Syria, Egypt, Sudan, Ethiopia, Kenya, Zambia, and Rhodesia. It was first described from Egypt by Motschulsky under the name *flavitarsis.*

Stenus peringueyi L. Benick

1 male, 9 females: SOUTH AFRICA: Transvaal, Wolmaransstad, 2 Mar. 1968, P. J. Spangler.

This polytypic species is known by its nominate form from South Africa and Angola.

Stenus cf. *kaguruensis* Bernhauer

1 female, L. Port, 20 Aug. 1900.

There are some females known from South Africa which differ slightly from the *kaguruensis* type. The males of these are not known at present, and it is impossible to decide whether the female cited above belongs to a new species or to *kaguruensis*. The true *Stenus kaguruensis* is known from Tanzania.

Stenus bifrons Waterhouse

1 male: SOUTH AFRICA: Natal, Mtubatuba, 24 & 25 Mar. 1968, P. J. Spangler.

This species is widely spread over tropical Africa and known from [Ivory Coast], Nigeria, [Cameroun], [Egypt], Ethiopia, Kenya, Tanzania, and Rhodesia [female-records in brackets].

Stenus nairobiensis Fauvel

1 male, 1 female: RHODESIA: 20 mi S. Bulawayo, 1 Apr. 1968, P. J. Spangler; 18 males, 19 females: Matopos National Park, 1 & 2 Apr. 1968, P. J. Spangler.

This is one of the most common African *Hypostenus*; known previously from Ethiopia, Somalia, Kenya, Tanzania, Congo, Angola, and South Africa.

Stenus (*Hypostenus*) *obconicus malawianus* Puthz, NEW SUBSPECIES

This new subspecies belongs to the *fulgidus*-group which is represented by 17 taxa in Africa and Madagascar. One of the species, *S. obconicus* Fauvel, is polytypic with subspecies known from Madagascar, Southwest Africa, the Cameroons, and West Africa.

Because of general similarity in appearance several of the taxa can be distinguished only by using the male sexual characters. This applies especially to *S. obconicus* and its subspecies. This new subspecies seems to represent *obconicus* in the southeastern part of Central Africa.

A full description is not necessary, the main differentiating characters are as follows: *Stenus obconicus malawianus* n. ssp. can be distinguished from *fulgidus* Puthz by its length, by its coarser and slightly sparser punctation of pronotum and elytra; from *decemguttatus* L. Benick by its more slender appearance and distinctly narrower pronotum; from *obconicus obconicus* Fauvel by its narrower body; from *obconicus quinquecarinatus* Cameron by the coarser punctation of its fore-parts which is not as dense as in that subspecies; from *obconicus damarensis* Puthz by its length; from *obconicus annectens* Puthz by its smaller head; from all mentioned above by the male sexual characters (as described by the author in previous articles).

Measurements (given in microns): width of head: 660; average distance between the eyes: 380; width of prothorax: 620; length of prothorax: 650; greatest width of elytra: 970; greatest length of elytra: 960; sutural length: 780. Posterior tarsi: 140-95-105-130-160. Length of body: 3.5mm to 4.0mm.

Quite shiny, black; coarsely and densely punctate; head with five shiny plaques; pronotum shiny medially, distinctly but not densely pubescent. Antennae with the basal portion yellowish brown, the club infuscate. First 2 segments and base of third segment of palpi yellowish brown, the re-

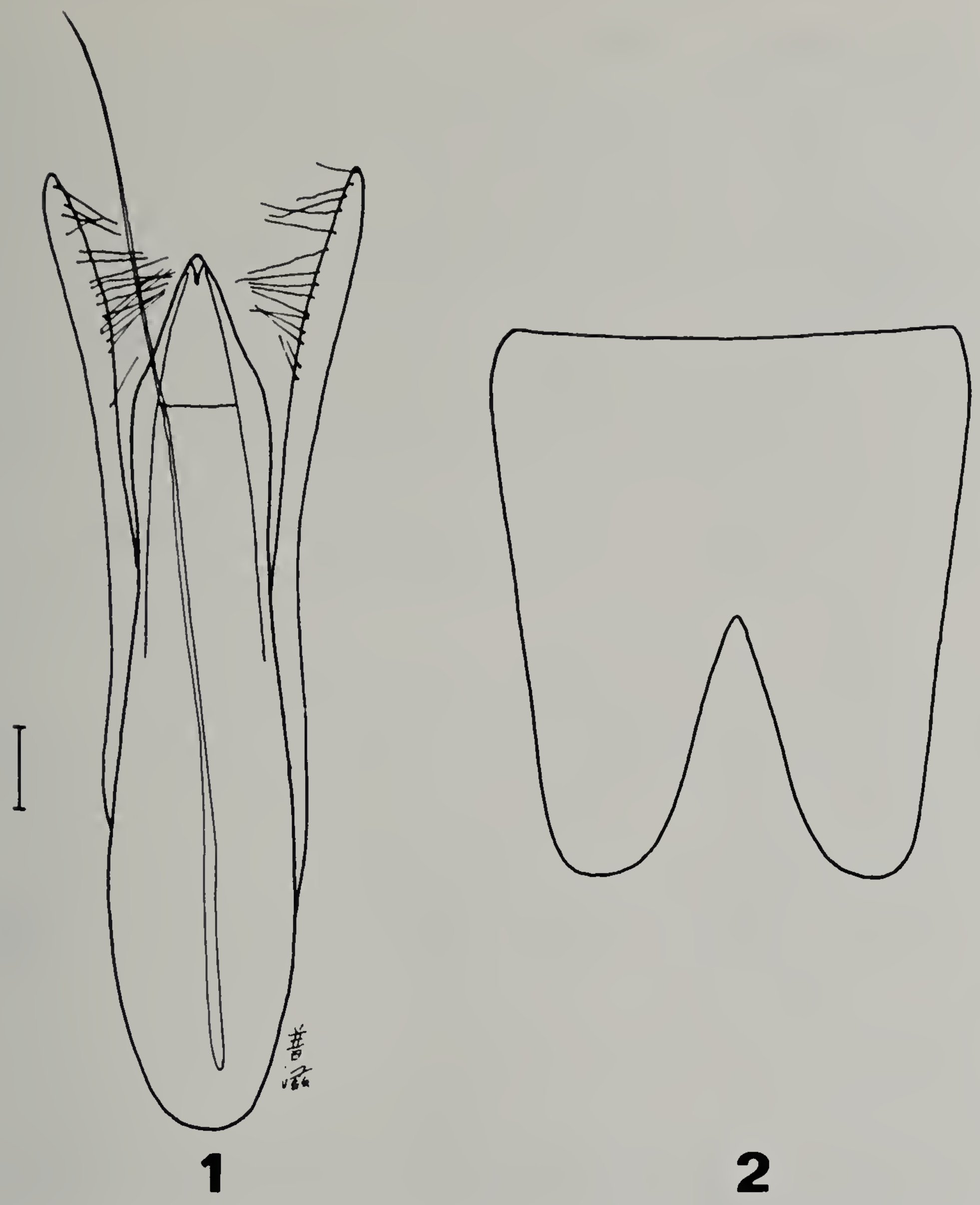

Fig. 1, 2: *Stenus* (*Hypostenus*) *obconicus malawianus* new subspecies (paratype): 1) ventral aspect of aedeagus without internal structures, except flagellum; 2) eighth sternite. Scale: 0.1mm.

mainder brown or darker. Legs dark brown to black, basal third of tibia and tarsi distinctly lighter. Labrum black, densely but distinctly pubescent.

MALE: legs quite slender, femora distinctly more slender than in *obconicus obconicus* and *obconicus quinquecarinatus,* tibia not distinctly curved. Fore sternites coarsely and densely punctured. Sternite 6 in posterior quarter with a broad but short impression, the posterior sides of which are only slightly carinate (not distinctly prominent in lateral aspect), punctation and pubescence of impression extremely fine and dense, posterior margin shallowly emarginate. Sternite 7 at posterior margin very shallowly emarginate, punctation and pubescence in middle denser and finer than on sides. Sternite 8 (Fig. 2). Sternite 9 about as in *obconicus.* Tergite 10 broadly rounded. The aedeagus (Fig. 1) is similar to that in *obconicus,* but the apical portion of the median lobe is more convex, the extreme apex has a short tooth, shorter than in *obconicus.* Inner structures (flagellum, etc.) as in *obconicus.* Parameres a little longer.

Holotype male USNM Type No. 71205 and male and female paratypes: MALAWI: 10 mi. W. Mlanje, 11 Apr. 1968, P. J. Spangler; 1 female (cf.): ZAMBIA: Namwala. Holotype and 1 paratype in the National Museum of Natural History in Washington, 1 paratype in the author's collection.

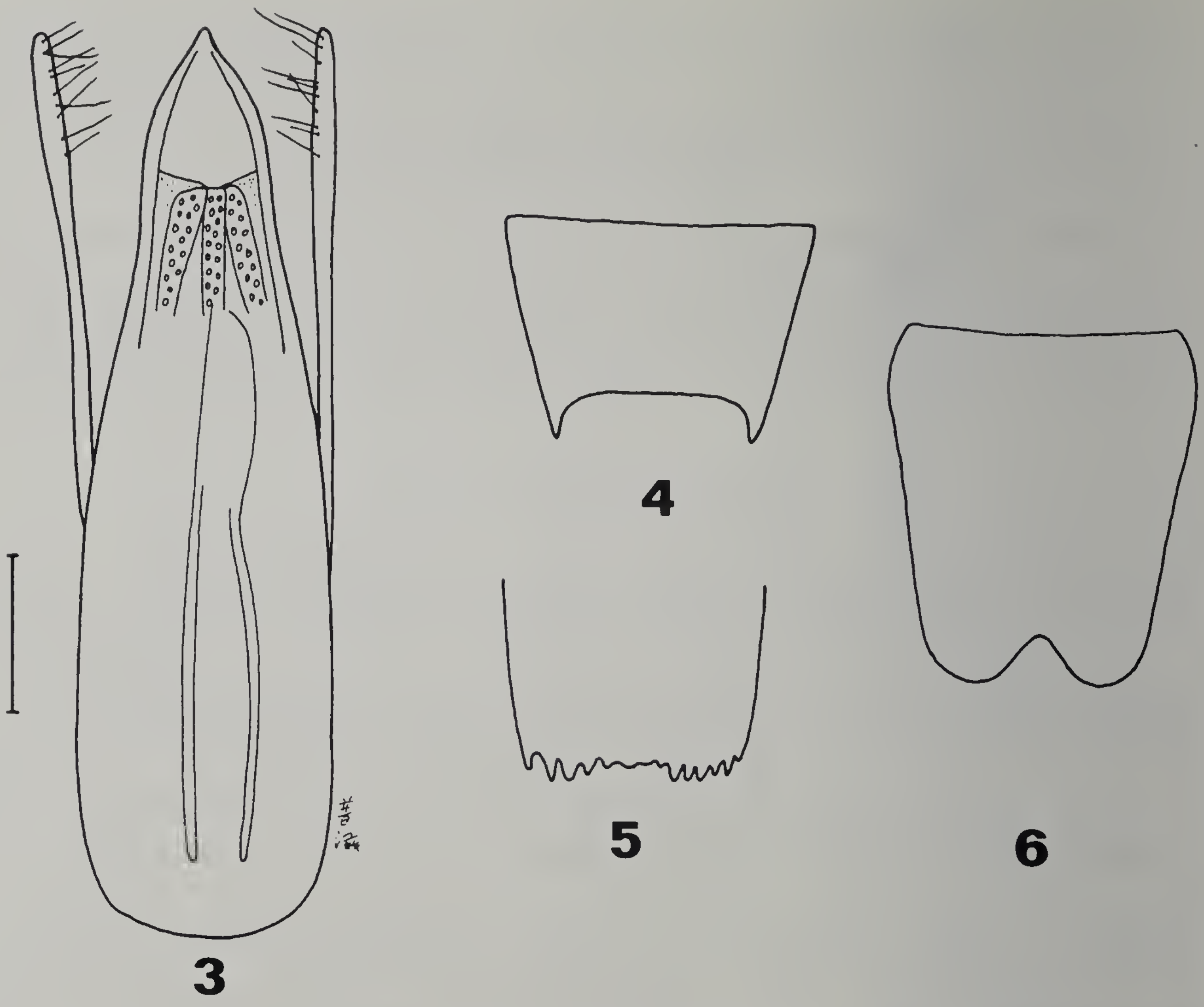

Fig. 3-6: *Stenus* (*Hypostenus*) *cooki* new species (holotype): 3) ventral aspect of aedeagus; 4) tenth tergite; 5) apical portion of ninth sternite; 6) eighth sternite (not the same scale). Scale: 0.1mm.

Stenus obconicus cf. *malawianus* Puthz

1 male, 1 female: SOUTH AFRICA: Natal, 13 mi. SW Empangeni, 24 Mar. 1968, P. J. Spangler.

These 2 specimens differ slightly from the types described above. These possibly represent another subspecies, closely allied to *malawianus*, but additional specimens are required to decide this question.

Stenus obconicus cf. *damarensis* Puthz

1 male, 5 females: SOUTH AFRICA: Natal, 13 mi. SW Empangeni, 24 Mar. 1968, P. J. Spangler.

These insects found together with those quoted above resemble closely the subspecies *damarensis*, described from South West Africa, but they are a little smaller and the median lobe is slightly longer than in the type.

Stenus spec. prope *obconicus* Fauvel

5 females: SOUTH AFRICA: Natal, Mtubatuba, 24 & 25 Mar. 1968, P. J. Spangler.

Undoubtedly these females belong to the polytypic species *obconicus* Fauvel, but because of extreme similarity in general appearance an exact identification is not possible without males.

Stenus (*Hypostenus*) *spangleri* Puthz, NEW SPECIES

This new species belongs to the *kisantuanus* group and seems to represent the sister species of *kisantuanus* Bernhauer. This species group contains 9 species, some of which are very similar in general appearance. In my revision of the African *Stenus* fauna (1971) I cited one female *kisantuanus* from Lake Naivasha, Kenya, that differs from the other known specimens by its length. In the same area Dr. P. J. Spangler collected a second female that exactly agrees with the first female from Lake Naivasha. Both specimens differ only slightly but distinctly from *kisantuanus*. I am now sure that these insects represent a new species of which, unfortunately, at present the male is unknown. Because the type locality is a place where collections are often made, I am convinced that the male will be found in the near future.

A full description is not necessary because of the great similarity with *kisantuanus*. The differences are as follows: the new species is distinctly larger, middle portion of front slightly broader, longitudinal furrows of front shallower and narrower, punctation of the side portions slightly denser. Elytra slightly shorter, punctation near suture sparser. Punctation of abdomen slightly but distinctly coarser; diameter of a puncture on tergite 5 about as large as 1 inner eye-facet, interstices (except in middle) slightly larger than diameter of punctures (in *kisantuanus* the punctures of tergite 5 are much smaller than 1 eye-facet, their interstices nearly twice as large as the diameter of punctures). Reticulation of surface denser.

Measurements (given in microns): width of head: 800; average distance between eyes: 490; width of prothorax: 630; length of prothorax: 650; greatest width of elytra: 980; greatest length of elytra: 980; sutural length: 810. Posterior tarsi: 270-125-90-95-160. Length of body: 4.0mm to 4.5mm.

Black with a greasy lustre; moderately coarsely and moderately densely punctate; with distinct, short, and moderately dense pubescence. Basal half of antenna yellowish brown, apical half dark brown. Palpi with the first 2 segments and extreme base of the third segment yellow, rest of third segment dark brown. Legs mainly dark; basal half of femur yellow, apical half sharply limited, black; tibia brownish, slightly lighter in middle; tarsal segments light brown with the apices blackish. Labrum black, quite densely pubescent.

Female: as in *kisantuanus*.

This new species, which I have the honor to dedicate to its collector, may be distinguished from all other species of the *kisantuanus* group by using my key to that group (Puthz 1971).

Holotype female, USNM Type No. 71206: KENYA: Lake Naivasha, 13 Jan. 1968, P. J. Spangler; paratype female: Naivasha, 2000 m, 13 & 14 Apr. 1957, P. Basilewsky and N. Leleup. Holotype in the National Museum of Natural History; paratype in the author's collection.

Stenus (*Hypostenus*) *callens* Puthz, NEW SPECIES

This new species belongs to the *spinifer* group which is defined by more or less long median spines at the apical margin of the tenth tergite (in both sexes !). In this group it is closely related to *S. angolanus* Puthz, *S. palifer* Puthz, and *S. paliferoides* Puthz.

Because of the intensive analysis of the *spinifer* group in my revision of the African *Stenus* a full diagnosis is not necessary. With regard to the shape of its tenth tergite, the new species might be confused only with the following taxa, from which it is distinguished as follows: from *grandipennis* L. Benick and *melanostolus* Puthz by its much more conspicuous callus on each elytron and darker legs (in these 2 species the extreme base of the tibia is remarkably lighter yellowish, which is not seen in the new species); from *angolanus* Puthz by its stronger elytral callus and less deep emargination of the eighth sternite in the male; from *palifer* Puthz and *paliferoides* Puthz by its stronger elytral callus and denser elytral punctation; from *depilis* L. Benick and its subspecies by its length; from all by the aedeagus. The aedeagus of *callens* resembles that of *angolanus* and *palifer,* but the median lobe is distinctly longer, narrower, and more straightly convergent towards the apex than in *angolanus,* narrower and distinctly shorter (in relation to the parameres) than in *palifer.*

The most remarkable character of the new species is its strong median elytral callus which is the strongest I have seen in any species of the *spinifer*-group.

Measurements (given in microns): width of head: 730; average distance between eyes: 380; length of prothorax: 650; width of prothorax: 580; greatest width of elytra: 940; greatest length of elytra: 910; sutural length: 750; posterior tarsi: 130-80-75-120-190. Length of body: 3.7mm to 4.2mm.

Black, shiny, coarsely and densely punctate, slightly pubescent. Antenna with the base light brown, the club dark. First segment of palpi yellow, second segment light brown, third segment dark. Legs black, tibiae, and tarsi sometimes slightly lighter. Labrum blackish, finely pubescent.

Male: Legs without any spines. Seventh sternite at posterior margin distinctly roundly emarginate. Eighth sternite with a notch in posterior sixth. Tenth tergite (also that of female) shortly tipped at apical middle, about as in *paliferoides* (see Fig. 14, Puthz 1968).

Holotype male, USNM Type No. 71207: SOUTH AFRICA: Cape Province, 22 mi. NW Knysna, 13 Mar. 1968, P. J. Spangler; 2 female paratypes: Cape Province, Plettenberg Bay, 14 Mar. 1968, P. J. Spangler; 1 female paratype: E. Cape Province, Alexandria district, pond, 13 Feb. 1955. Holotype and paratype in the National Museum of Natural History, paratypes also in the author's collection.

The following specimens are not designated as paratypes because their genitalia are slightly different from the types (median lobe shorter and a little more broadly rounded at apex). I suppose that these differences belong to the variability.

6 males, 8 females: SOUTH AFRICA: Natal, 13 mi. SW Empangeni, 24 Mar. 1968, P. J. Spangler; 2 females: Natal, Mtubatuba, 24 & 25 Mar. 1968, P. J. Spangler.

Stenus grandipennis L. Benick

4 males, 9 females: SOUTH AFRICA: Cape Province, Plettenberg Bay, 14 Mar. 1968, P. J. Spangler; 1 male: Cape Province: Touwsrivier, 4 Mar. 1968, P. J. Spangler; 1 male, 5 females: Cape Province, Cape Good Hope

Nature Reserve, 7-10 Mar. 1968, P. J. Spangler; 7 males, 10 females: Cape Province, Grahamstown, 15-19 Mar. 1968, P. J. Spangler.

This species is known only from the southern tip of the African continent. It seems to be more variable than supposed from the types.

Stenus melanostolus Puthz

1 male, 1 female: SOUTH AFRICA: Transvaal, 11 mi. SE Middleburg, 27 Mar. 1968, P. J. Spangler.

This species was known before by only 2 specimens from northern South Africa. It is very closely allied to *grandipennis* L. Benick if not a subspecies of that more southerly distributed species.

Stenus prospector Fauvel

32 males, 25 females: MALAWI: 10 mi. W. Mlanje, 11 Apr. 1968, P. J. Spangler; 1 female: 25 mi. SE Limbe, 11 Apr. 1968, P. J. Spangler; 1 female: KENYA: 6 mi. SW Nairobi, 13 Apr. 1968, P. J. Spangler; 1 female: SOUTH AFRICA: Natal, 13 mi. SW Empangeni, 24 Mar. 1968, P. J. Spangler.

This species is very remarkable because of the lateral spines of the pronotum. It is widely distributed throughout Africa and is known from Senegal, Haute Volta, Nigeria, Chad, Sudan, Kenya, Tanzania, Congo and Zambia.

Stenus (*Hypostenus*) *spinicollis* Puthz, NEW SPECIES

This new species belongs to the *spinifer* group and closely resembles *prospector* Fauvel, its sister species. A comparison of both taxa will be sufficient for describing it.

Black, dull, very coarsely, deeply, and extremely densely punctate with a short and shiny golden pubescence. Antennae reddish yellow, first 2 segments sometimes brownish, club brownish yellow. Palpi yellowish. Legs reddish brown, knees infuscate, tarsi dark-yellowish. Labrum brownish. Length of body: 3.3mm to 4.0mm.

In proportions and lateral spines of prothorax it is similar to *prospector,* but the new species is larger and the fore parts distinctly coarser and more densely punctate. Front extremely densely punctate, entirely dull. Also the abdomen is duller because of its denser punctation.

Tenth tergite and sexual characters as in *prospector*, but the aedeagus is different: longer and narrower, the median lobe as long as the parameres, apical emargination of median lobe conspicuously more shallow than in *prospector,* nearly blunted. Parameres at their ends distinctly less spoon-like than in *prospector.*

Holotype male: "Abyssinie" (ex coll. Fauvel), 1 female paratype: ibidem. Holotype in the Institut Royal des Sciences Naturelles de Belgique, Brussels, paratype in the author's collection.

Stenus (*Hypostenus*) *cooki* Puthz, NEW SPECIES

This new species belongs to the *argentifer* group, the species of which have apomorphic characters of the tenth tergite (forks, lateral spines, anchors, etc., but not a median spine as in the *spinifer* group). The *argentifer* group is the sister group of the Oriental *cursorius* group; both belong to 1 monophyletic group which has an Afro-indian distribution.

Because of intensive analysis of the *argentifer* group in my revision of the African *Stenus*, a full description of this new species is not necessary. In its coloration and the shape of the tenth tergite it could only be confused with the following taxa, from which it is distinguished as follows: from *cursorius rorellus* Fauvel, *cursorius caffer* Puthz, and *cursorius minimus* Puthz by its length, much stronger punctation (especially remarkable on head), less distinct pubescence, less deep reticulation and less infuscate knees, not to regard the insect's proportions; from *tenganus* Tott., which is most similar to the new species, by its broader front; from all by its sexual characters.

Measurements (given in microns): width of head: 630; average distance between eyes: 490; width of prothorax: 470; length of prothorax: 510; greatest width of elytra: 660; greatest length of elytra: 660; sutural length: 520. Posterior tarsi: 125-63-50-62-95. Length of body: 2.8mm to 3.6mm.

Slightly shiny, nearly dull, black, very coarsely and extremely densely punctured, with very short argenteous pubescence. Antenna with the first segment brownish, the following segments yellowish red, the club slightly infuscate. Palpi yellowish. Legs reddish yellow, knees indistinctly infuscate. Labrum dark brown, moderately densely pubescent. Tenth tergite (Fig. 4).

Male: Legs lack special sexual characters. Fore-sternites coarsely and densely punctate. Seventh sternite with an extremely shallow emargination at posterior margin; slightly finer but distinctly more densely punctate and pubescent in front of emargination than on the sides. Eighth sternite (Fig. 6). Ninth sternite (Fig. 5). Aedeagus (Fig. 3).

I dedicate this remarkable new species to its collector, Orator Fuller Cook, one of the pioneers in the entomological investigation of Africa.

Holotype male, USNM Type No. 71208 and 1 female paratype: LIBERIA: Mt. Coffee, Feb. 1897, O. F. Cook. Holotype in the National Museum of Natural History, paratype in the author's collection.

Stenus cruralis Bernhauer

6 males, 4 females: LIBERIA: Mt. Coffee, Mar. 1897, O. F. Cook.

This species is known also from the Ivory Coast and the Congo.

Stenus cursorius caffer Puthz

36 specimens: S. RHODESIA, Sept. 1909, C. W. Howard.

This subspecies represents *cursorius* in southern Africa; it is well known from South Africa, South Rhodesia, Zambia, and Angola.

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(*continued from inside front cover*)

or counties listed. Dates are listed by day, month (in Roman numerals), and last 2 digits of the year. Listing of ecological data is encouraged. Location of specimens should be shown in brackets; if the data is extensive these should be abbreviated as shown and the abbreviations listed in the text.

Any article concerning Coleoptera will be considered. Descriptions of new taxa must contain keys (or be correlated with existing keys) and illustrations. All manuscripts should be typed on 8½x11" opaque white paper with 1 inch margins. They should be typed on one side only and double spaced throughout (including title, footnotes, tables, figure legends, and references). All scientific names should be underlined. Use the following order: title, author, author's address, abstract, body of text, references cited, and figures. All footnotes, tables, and figure legends should be provided on separate sheets and double spaced. Indicate approximate figure and table locations in pencil in the margin of the manuscript.

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NOTICES

Notices to appear on this page are a free service to members and subscribers. Such copy will be limited to the back page, the older notices being moved up and replaced with the newest ones at the bottom. The editor reserves the right to reword such notices for brevity, consistency, and clarity.

VIET NAM COLLECTION: Will exchange recently collected material from S.E. Asia for material from Southwestern U.S.A. Anyone wishing to determine material from this collection may keep the determined specimens. Bruce W. Miller, Dept. of Biological Sciences, Univ. of Nevada at Las Vegas, Las Vegas, NV 89109.

COLYDIIDAE: Revising the family for America north of Mexico. Wish to borrow material; will exchange for other Coleoptera. Karl H. Stephan, 3038 E. Eastland, Tucson, AZ 85716.

LIMNEBIIDAE: Revising the genus **Ochthebius** for North America. Desire material mounted or in alcohol. F. E. Wood, Dept. Ent., Univ. of Md., College Park, MD 20742.

Compiling check-list: Beetles of Clark Co., Nev. I would like to correspond with Coleopterists who have collected in southern Nevada. B. W. Miller, Dept. of Biol., Univ. of Nev. at Las Vegas, Las Vegas, NV 89109.

SWITZERLAND EXCHANGE: Interested in exchanging the following families: Cerambycidae, Carabidae, Lucanidae, Scarabaeidae (Cetoniinae, Goliathinae, Dynastinae). Ulysse Auberson, 6 les prés du lac, 1400 yverdon VD, Switzerland.

BEETLE MITES: I am engaged in research on Poromegistidae which are pharetic on insects. They are known from Carabidae (**Scarites** & **Harpalus**), Scarabaeidae, Passalidae (in Australia), millipedes, and ants. Will exchange or purchase these mites in alcohol. W. J. Voss, Texas Tech. College, Dept. of Biology, Lubbock, TX 79409.

SHARP & MUIR: THE COMPARATIVE ANATOMY OF THE MALE GENITAL TUBE IN COLEOPTERA. The classic 1912 monograph and 6 other papers by the same authors, 304 p., 43 pl., bound; $10.00. An essential book for all coleopterists. Entomological Society of America, 4603 Calvert Rd., College Park, MD 20740.

CICINDELIDAE: The following 3 papers are in preparation: "Cicindelidae of Quebec," "Food of cicindelids of the world," and "**Cicindela ancocisconensis** Harris." Label data, observations, and food habit notes would be appreciated. Andre Larochelle, College Bourget, C. P. 430, Rigaud, Quebec, Canada.

SCARABAEIDAE: Studying myrmecophilous and termitophilous Aphodiinae. Request loan of New World material especially. Will sort from general scarab collections or from light trap samples. Robert E. Woodruff, Fla. Dept. Agr., P. O. Box 1269, Gainesville, FL 32601.

HYDROPHILIDAE: Presently revising the genus **Hydrochus** from North, South, and Central America, including the Antilles. Request loan of any material from the Western Hemisphere. John L. Hellman, Ent. Dept., Univ. Maryland, College Park, MD 20742.

TENEBRIONIDAE: Building world-wide reference collection. Will purchase or exchange other Coleoptera. Especially desire immature stages. Kirby W. Brown, Peabody Museum, Yale Univ., New Haven, CT 06520.

HELODIDAE: Revising **Elodes**, need material from NW, W, SW, & S. Will pay postage. Prefer wet material, but mounted or dry OK. Desire larvae also. G. G. Kennen, 381 N. Central Ave., Ramsey, N.J. 07446.

CERAMBYCIDAE: Longicornes du Laos by Gressitt, Rondon, and Breuning. Pacific Insects Monograph 24, 1970, 651 p., 102 pl. (2 color), maps. Over 1000 species illustrated. $17.50 hard cover; $16.00 paper. Bishop Museum Press, Box 6037, Honolulu, HI 96818.

WORLD RESEARCH DIRECTORY: Richard L. Jacques and Dr. Ross H. Arnett, Jr. are preparing a world list of **current** research projects on Coleoptera. A volume will be published as a companion to the recently published "Directory of Coleoptera Collections." Anyone wishing to have a research project listed should write to R. L. Jacques, Dept. of Entomology, Purdue University, Lafayette, Indiana 47907. Forms will be provided.

CLEROIDEA: Conducting world-wide research on internal anatomy. Will exchange North and Central American groups for liquid (10% Formalin, etc.) preserved Cleroidea. Building world reference collection of Cleridae; will purchase or exchange. Ginter Ekis, Dept. Ent. & Econ. Zool., Rutgers, Univ., New Brunswick, N.J. 08903.

SCARABAEIDAE: Wanted, various species of **Megasoma**, male and female, major and minor forms. Will exchange pairs of **M. pachecoi.** Terry W. Taylor, 8529 Norwood Place, Rosemead, CA 91770.

OEDEMERIDAE: Specimens needed for World Revision now under way. Need especially material from Africa, Asia, and South America. Ross H. Arnett, Jr., care of Florida State Collection of Arthropods, P. O. Box 1269, Gainesville, FL 32601.

CICINDELIDAE: Interested in obtaining specimens of **Cicindela hirticollis ponderosa** Thoms. from area of Veracruz, Mexico. Will exchange other Coleoptera. R. C. Graves, 627 Crestview, Bowling Green, Ohio 43402.

INSECT WORLD DIGEST: A new monthly magazine for entomologists, containing news, views, subject bibliographies, etc. For more information write: IWD, P. O. Box 4068, Tallahassee, FL 32303.

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THE COLEOPTERISTS BULLETIN

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THE COLEOPTERISTS BULLETIN

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The **Coleopterists Bulletin** is published quarterly, beginning in March, by the Coleopterists Society. All manuscripts, editorial questions, or business matters should be sent to the editor: Dr. Robert E. Woodruff, Florida Department of Agriculture, P.O. Box 1269, Gainesville, Florida 32601.

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The **Coleopterists Newsletter** is a mimeographed publication issued twice a year and mailed to all members of the Coleopterists Society regardless of whether they have a subscription to the **Coleopterists Bulletin.** News items and correspondence concerning the **Newsletter** should be sent to the editor: Dr. C. W. O'Brien, Div. Entomology, Texas Tech Univ., Lubbock, TX 79409.

NOTICE TO AUTHORS

Manuscripts will be considered from any authors, although those from members of the Coleopterists Society will be given priority. It is suggested that all prospective authors join the Society. All manuscripts should conform to instructions in the **Style Manual for Biological Journals** (2nd Ed.) prepared by the Committee on Form and Style of the Conference of Biological Editors, and published by the American Institute of Biological Sciences, 2000 P Street NW, Washington, D. C. 20063.

The following exceptions are noted: 1) All geographical names are to be spelled out, 2) use words, not symbols, for male and female, 3) use numerals throughout, except to begin a sentence, 4) entomology, -ical, -ist, etc. are to be abbreviated Ent. in literature citations.

Specimen label data should be listed in the following manner: MEXICO: State of Veracruz, Fortin de las Flores, 10-VIII-70, I. B. Jones, under bark of **Pinus moctezumae**, 7000ft. [USNM] (2). The number in parentheses indicates the number of specimens. Geographical names are listed in order with largest units first, with states, departments, provinces, parishes, and/

Continued inside back cover

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NOTES ON ANTHRIBID WEEVILS. III. NEW SPECIES AND RECORDS PRIMARILY FROM ARIZONA (COLEOPTERA: ANTHRIBIDAE)

BARRY D. VALENTINE

Department of Zoology, The Ohio State University, Columbus, Ohio 43210.

ABSTRACT

Redescriptions and new records are presented for: *Ischnocerus impressicollis* Jordan from Mexico (Morelos) and Arizona, *Ischnocerus angulatus* Martin from Arizona, *Toxonotus cornutus* (Say) from Mexico (Durango, Chihuahua, and Nayarit), and *Toxonotus vagus* (Horn) from Mexico (Baja California, Morelos) and Arizona. *Eugonus bicolor* n.sp. and *Euparius pictus* n.sp. are described and illustrated from SE. Arizona. *Euparius subtesselatus* Schaeffer is recorded from Texas, New Mexico, Arizona, and Mexico (Chihuahua and Durango).

This is the third in a series of papers presenting taxonomic information developed, in large part, incidentally to other studies. The data presented record 4 species new to the United States fauna, describe 2 of these as new species, and provide new distribution data for 2 additional species in the United States (Arizona, Texas) and northern Mexico. The new species were mentioned by me (1960) but not described due to inadequate material. Both are from extreme southeastern Arizona.

ACKNOWLEDGEMENTS

Part of these studies were made at the British Museum (Natural History) while I was the recipient of a National Science Foundation travel grant from the Entomological Society of America to attend the XIIth International Congress of Entomology; and it is my special pleasure to express my gratitude to the authorities of the British Museum, especially Mr. R. T. Thompson, for unfailing assistance, courtesy, and friendship. The important specimens from the State of Morelos, Mexico were collected by Dr. G. E. Ball in conjunction with work on NSF Grant GB-3312. Figures 1 and 2 were drawn by Mr. David M. Dennis, scientific illustrator of the College of Biological Sciences of The Ohio State University.

The material studied is from the following institutions or personal collections:

American Museum of Natural History [AMNH]; Barry D. Valentine [BDVC]; British Museum (Natural History) [BMNH]; California Academy of Sciences [CASC]; Charles W. O'Brien [CWOB]; Florida State Collection of Arthropods [FSCA]; Henry and Ann Howden [HAHC]; Museum of Comparative Zoology [MCZC]; Ohio State University [OSUC]; University of Arizona[UAIC]; University of California at Davis[UCDC]; United States National Museum [USNM].

ISCHNOCERUS SCHÖNHERR

Ischnocerus Schönherr, 1839:191. Type: *Ischnocerus infuscatus* Fahraeus, 1839, by original designation.

Meconemus Labram and Imhoff, 1842:40. Type: *Meconemus tuberculatus* Labram and Imhoff, 1842, by monotypy. See Valentine (1960:55-56) for discussion of this synonomy.

The original descriptions of the following 2 species are so similar that they appeared to be synonyms. Examination of type material and topotypes of both taxa shows that, despite a striking superficial similarity in color pattern (both have dense white pubescence on rostrum, pronotal disc, scutellum, and pygidium), the 2 are distinct. *Ischnocerus angulatus* is still known only from Arizona; however, *Ischnocerus impressicollis*, described from Mexico, is here reported from the United States for the first time. Both species belong to the group which includes the type species, *Ischnocerus infuscatus*, all characterized by a small post-ocular tubercle on the anterior edge of the prothorax.

Ischnocerus impressicollis Jordan

Ischnocerus impressicollis Jordan, 1895:373. Holotype [BMNH], Mexico, Cuernavaca. Jordan, 1906:306, pl. 10, fig. 5,5a.

Pronotum with antebasal carina clearly interrupted medially, the carinal ends on either side of the gap curving towards the scutellum; pronotal base with white pubescence extending laterally slightly beyond the basal tuft of the third elytral interspace, the white patch wider at transverse carina than at true pronotal base; elytral suture with a very small post-scutellar patch of creamy white to pale tan bristles of the same color as the adjacent scutellum, this patch, at best, about as large as the scutellum; elytral apex with part of declivity invisable from above, due to a broad preapical callus which is conspicuously higher than the declivous portion of the suture; mesepisternum with sparse pubescence, and dispersely punctured.

Specimens examined: Mexico, State of Morelos, Cuernavaca, male Holotype, [BMNH]; 5.4 mi. E. Cuernavaca, 4600′, 29-30-VI-66, pedregal, G. E. Ball and D. R. Whitehead [BDVC] (2). United States, Arizona, (Cochise Co.), Portal, 7-VII-67, F. J. Moore, [OSUC, BDVC] (2). *FIRST UNITED STATES RECORD.*

Ischnocerus angulatus Martin

Ischnocerus angulata Martin, 1930:71. Holotype: [CASC #2977], Arizona, near Patagonia, 9 July, 1930, (J. O. Martin), on the dead branches of a large willow tree.

Pronotum with antebasal carina clearly entire, the central portion forming a large posteriorly-directed loop; pronotal base with white pubescence extending laterally as far as the basal tuft of the third elytral interspace, the basal white patch not widened next to the transverse carina; elytral suture without a post-scutellar pale spot, the pubescence brown or gray, contrasting with the creamy scutellum; elytral apex with entire apical declivity visable from above, the preapical callus absent or only slightly indicated; mesepisternum glabrous, polished, with at most 2 or 3 punctures.

Specimens examined: United States, Arizona, Santa Cruz Co., Patagonia, 9-VII-30, J. O. Martin, [CASC] (1 paratype); Patagonia, VII-36, E. S. Ross, [BDVC] (1); Nogales, 2-VIII-55, D. J. & J. N. Knull, [BDVC] (1); Nogales, 15-VII-52, D. J. & J. N. Knull, [OSUC] (1); Cochise Co., Portal, 7-VII-67, F. J. Moore, [OSUC] (1).

TOXONOTUS Lacordaire

Toxonotus Lacordaire, 1866:575. Type: *Anthribus fascicularis* Schönherr, 1833, by monotypy.

Neanthribus Jordan, 1906:341. Type: *Neanthribus championi* Jordan, 1906, by original designation. For synonymy see Valentine, 1960:65-66.

Both species discussed below have 3 black spots on the elytral apex, 1 on the suture and 1 on each elytral tip. Included in the discussion are a new record for the United States (Arizona), and new records for Mexico.

Toxonotus vagus (HORN)

Anthribus vagus Horn, 1894:359, 448. Holotype originally in the California Academy of Sciences, San Francisco, probably destroyed by the 1906 fire and earthquake, from Baja California, "El Taste".

Jordan's (1906) study of the Central American species of "*Neanthribus*" omits this Mexican species described from Baja California. *Toxonotus vagus* looks like a diffusely marked *T. cornutus* (Say) but lacks the small apical tufts on the pronotum, and it has only 1 basal tuft on the elytra, in the third interspace. *Toxonotus cornutus* has a pair of small tufts on the pronotal apex (as does *T. championi* Jordan, and *T. segregus* Jordan), and basal tufts in elytral interspaces 3 and 5. In Jordan's key (1906:342) to the Central American species, *T. vagus* runs to the first half of couplet "f". but has only 1 tuft at the elytral base. In my key to United States species (1960:67), it runs to the first half of couplet 3, but lacks the lateral prothoracic ridge anterior to the lateral carina.

The type locality of *T. vagus* at El Taste is mapped and briefly described by Eisen (1895). He says "El Taste (or Candelario) mountain, c. 5,500 ft. altitude, at the southern end of the high sierras of the Cape region; forming roughly an equilateral triangle with Cape San Lucas and San Jose del Cabo." To my knowledge, the species has not been reported since Horn's description. The following records include the first for the Mexican mainland and the first for the United States.

Specimens examined: MEXICO, State of Baja California Sur, 5 mi. N. El Refugio, 4-VII-38, Michelbacher & Ross [CASC] (1); Triunfo, 13-VII-38, Michelbacher & Ross [CASC, BDVC] (2); Mesquital, 22-VI-38, Michelbacher & Ross [BDVC] (1); 3 mi. E. of La Burrera, Sierra de la Victoria Mts., 1800 ft., 18-X-68, E. L. Sleeper & F. J. Moore, beating wild cotton [OSUC] (2); State of Morelos, 3.6 mi. E. Cuernavaca. 4600′, pedregal, 24-XI-65, G. E. Ball, D. R. Whitehead [BDVC] (1). UNITED STATES, Arizona, Santa Cruz Co., Santa Rita Mountains, 24-VI-39, D. J. & J. N. Knull Collrs., [OSUC] (1). FIRST RECORD IN THE UNITED STATES.

Toxonotus cornutus (SAY)

Anthribus cornutus Say, 1831:4. Holotype: apparently destroyed, from Indiana.

This is the commonest and most widespread species in the United States, ranging from New Jersey to Florida, west to Indiana and Texas. It is usually recognized at a glance by the dense antemedian patch of white pubescence on each elytron; however, a few specimens have these conspicuous spots reduced or even absent. Other features of the species are the presence of 2 tufts on the apical margin of the pronotum, 2 tufts near the base of each elytron in interspaces 3 and 5, and the absence of a longitudinal ridge on the side of the prothorax anterior to the end of the lateral carina.

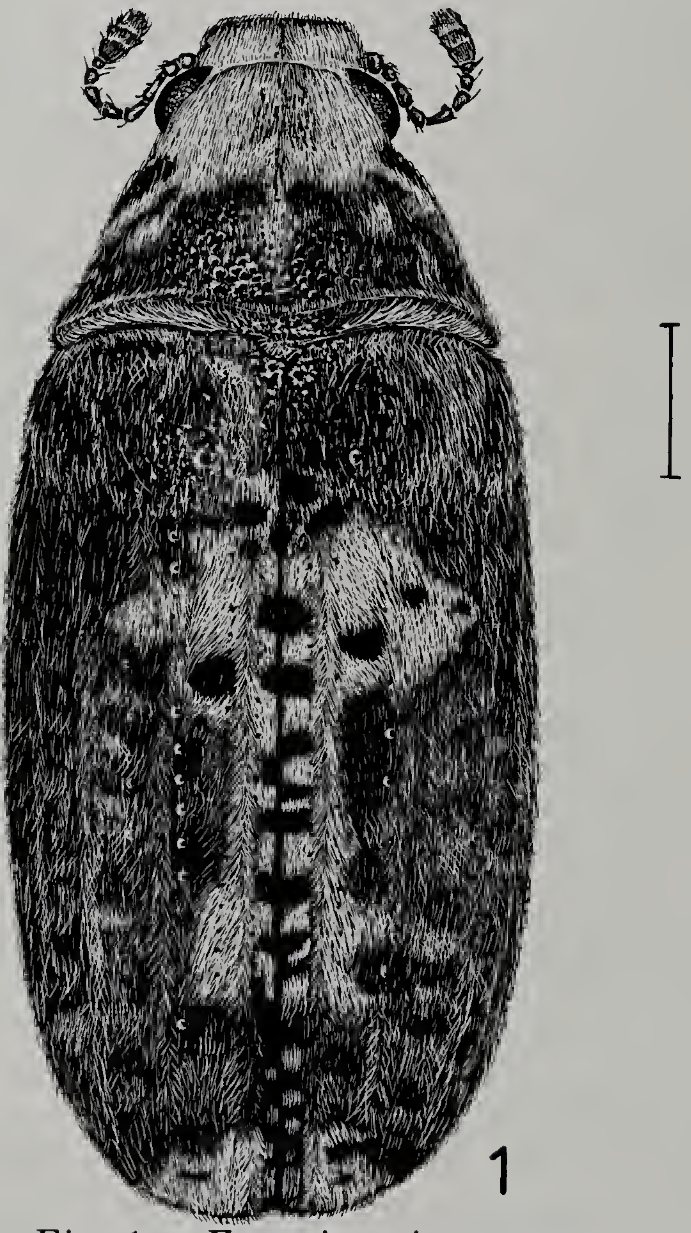
The species is here recorded from Mexico for the first time. In Jordan's key (1906:342) to the Central American species, *T. cornutus* runs to couplet "b." It differs from *T. championi* Jordan in lacking the stellate black patch on the pronotum, and the pale postmedian chevron; it differs from *T. segregus* Jordan in having transverse, not diagonal, sutural tesselations, and the large second tuft of the third interspace being mostly dark, not conspicuously pale.

Specimens examined: MEXICO, State of Durango, San Juan del Rio, 5,200 ft., 30-VII-47, D. Rockefeller Exp., Gertsch, Cazier, [AMNH, BDVC] (2). State of Chihuahua, 25 mi. S. W. Camargo, 14-VII-47, D. Rockefeller Exp. Gertsch, Cazier, [AMNH, BDVC] (2). State of Nayarit, Mecatan, 800′, 23-V-49, E. M. Brandt, [AMNH] (1). FIRST RECORDS IN MEXICO.

EUPARIUS SCHÖNHERR

Euparius Schönherr, 1823:1135. Type: *Anthribus lunatus* Fabricius, 1801, by monotypy. (*A. lunatus* Fabr. = *Macrocephalus marmoreus* Olivier, 1795). See Valentine (1960:56) for synonymy.

There are 55 described species in the New World plus others in the Indo-Australian area. In addition, the British Museum has at least 10 new species from the New World, and I have others. In this entire assembledge, there is nothing which might be confused with the very distinct new species described below from Arizona. When I mentioned the existence of this species in 1960, I had seen only 2 specimens, one of which was not available for loan. I now know of 27 specimens, most collected within the past 15 years.



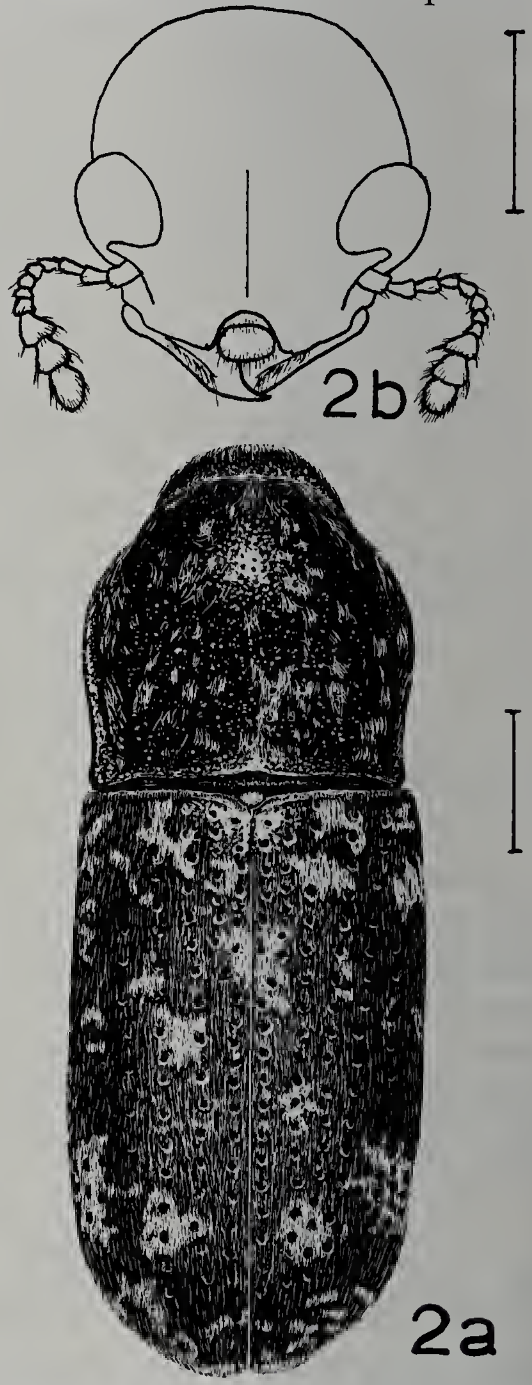


Fig. 1: *Euparius pictus* n. sp., male paratopotype, dorsal view (pronotum foreshortened due to angle; line = 1mm). Fig. 2: *Eugonus bicolor* n. sp., male holotype (a: dorsal view, line = 1mm; b: facial view, line = 0.5mm.

Euparius pictus Valentine, NEW SPECIES
(Fig. 1, 4)

HOLOTYPE, male, labelled "S.W.R.S. [Southwest Research Station], 5 mi. W. Portal, 5400 ft. Cochise Co., Ariz. Aug. 28, 1959" "M. Statham Collector", [AMNH].

DIAGNOSIS: Pubescence tricolored, blackish, white, and brown, the white densest on face, on anterior half of pronotum, on elytral disc forming an elongate sutural patch narrowest in center and widest anteriorly, on apical declivity, on pygidium, on tibiae forming a wide median band, and on first tarsal segment except apex; terminal segment of antenna black, not pale; venter punctate, coarsest on prosternum, weakest on abdomen; intercoxal process of mesosternum not tuberculate.

DESCRIPTION: Holotype (variation in parentheses); length, head excluded 8.5 (7.5 to 9.0) mm. Form elongate cylindrical, dorsum arched to give a weakly hump-backed look. Derm varying shades of brown, black, and red, the redder shades especially evident on even numbered eytral interspaces, on metathorax, and abdominal periphery. Dorsal pubescence on head and rostrum white when degreased; on pronotum white on anterior half, extending laterally to the level of the upper portion of eye, and posteriorly continued as irregular streaks and disconnected spots the most obvious on the median line, the lateral streaks sometimes contacting the transverse carina opposite the base of the sixth elytral interspace, dark areas of pronotum irregularly mottled; on elytra the elongate white sutural patch not conspicuously margined with black except where it contacts the tesselations in the odd interspaces, especially the third, the white apical declivity with a small blackish sutural spot (or tesselation) almost at the elytral apex; scutellum and pygidium white; venter sparsely white or pale gray, densest in the center of the metathorax and at the abdominal apex; legs as in diagnosis. *Head:* densely punctate, rostrum and frons with a weak median carina; eye truncate opposite the scrobes; antennae with segment III considerably longer than II, III to VII progressively shorter, VIII smaller than (or equal to) IX, IX-XI forming an abrupt elongate black or grayish black club, the segments almost symetrical, IX triangular, X broader than long, XI much longer than broad, the club about as long as IV to VIII combined. *Prothorax*: strongly narrowed from base to apex, sides only slightly inflated, disc faintly swollen on either side of the weakly depressed median line, sculpture of small very dense punctures; transverse carina following curve of elytral base, curving abruptly into the lateral carina, the angle slightly less than 90°, lateral carina weakly sinuate and extending a little less than half way to anterior margin; carinula well developed, short; dorsal punctures dense, small, and shallow, the rims tending to form weak rugae laterally; ventral punctures much larger, deeper, less crowded, and without raised rims; antecoxal strip weakly concave medially, length subequal or slightly shorter than procoxal diameter; ventro-lateral posterior margin with a small flat tooth or condyle about equidistant between coxa and hind angle. *Scutellum*: very small, flush with elytral margins, sparsely pale pubescent. *Elytra*: elongate, parallel-sided, almost cylindrical, the third interspace slightly swollen, the second weakly depressed, but without the large discal concavity of some Neotropical species; humeral callus weakly developed, subbasal callus present but not prominent; striae weakly impressed, the punctures deep, becoming shallow and smaller above apical declivity; the sutural patch of pale pubescence extends laterally to the seventh interspace at its anterior end, then abruptly narrows to include the first and second interspaces, and then widens to include the third interspace posteriorly, it encloses prominent blackish tessellations along the suture and a few larger spots in the third interspace. *Pygidium*: entirely pale pubescent, the cuticle mottled pale orange and brown (darker in some other specimens); the punctures fine, the interspaces irregularly roughened. *Abdomen*: with each sternite more densely punctured than the segment before, the punctures small but variable in size, the largest punctures just posterior to the hind coxae. *Pterothorax*: swollen medially; with many large, deep punctures on the metepisternum and metasternum, only a few smaller punctures on the metepimeron; median groove of metasternum glabrous. *Legs*: not elongate, hind femora not surpassing 3rd visable abdominal sternite; tarsi narrow and cylindical; claws with an acute median tooth; pubescence as in diagnosis; femora mostly pale pubescent but not as dense as other pale areas. *Male*: metasternum not modified; abdomen with a median longitudinal concave area limited laterally by weak ridges, the ridge accentuated by diffuse patches of pale semi-erect bristles on sternites 2, 3, and 4; fifth visable sternite shorter than fourth; hind femora with small, low, rounded tubercles scattered over the posterior surface.

SPECIMENS EXAMINED: total 27, all but 1 from the Chiricahua Mountains, Cochise County, in extreme southeastern Arizona. Holotype male, allotype female, and 20 paratopotypes collected at the Southwest Research Station, 5 mi. W. Portal, 5400 ft., Cochise Co., Ariz. (collectors and dates indicated): M. Statham, 28-VIII-59, (holotype, allotype and 2 male paratopotypes); M. Statham, 14-VIII-59, (1 female paratopotype); M. Statham, 16-VIII-59, (2 male paratopotypes); M. Statham, 23-VIII-59, (1 male paratopotype); M. Statham, 9-IX-59, (1 male paratopotype); M. Statham, 28-IX-61, (1 male, 1 female paratopotype); M. A. Cazier, 22-IX-60), (1 female paratopotype); C. and M. Cazier, 28-30-IX-60), (1 female paratopotype); W. Gertsch and M. Cazier, 11-IX-50, (1 male paratopotype), these specimens divided between AMNH, which has the holotype and allotype, and BDVC; C. G. Moore, 25-XII-58, [UCDC] (1 female paratopotype); J. H. McNally, 25-VIII-58, [CWOB] (1 female paratopotype); P. H. Arnaud, 7-IX-59 [BDVC] (1 female paratopotype); H. V. Weems, Jr., 30-VIII-58, [FSCA] (1 male paratopotype); H. V. Weems, Jr., 7-IX-58, [FSCA] (1 female paratopotype); H. V. Weems, Jr., 9-IX-58; [FSCA, BDVC] (2 male, 1 female paratopotypes). In addition to these specimens from the station, there are also 5 others: Chiricahua Mts., 10-VIII-61, D. J. & J. N. Knull, [OSUC] (1 female paratype); Chiricahua Mts., 30-VII-15, E. C. Van Dyke Collection, [CASC] (1 paratype); Portal, [4700], 7-VII-67, F. J. Moore, [OSUC, BDVC] (2 female paratypes); Huachuca Mts., Garces, 4500-6500, June-September, Biederman, [MCZC, H. C. Fall Collection] (1 paratype).

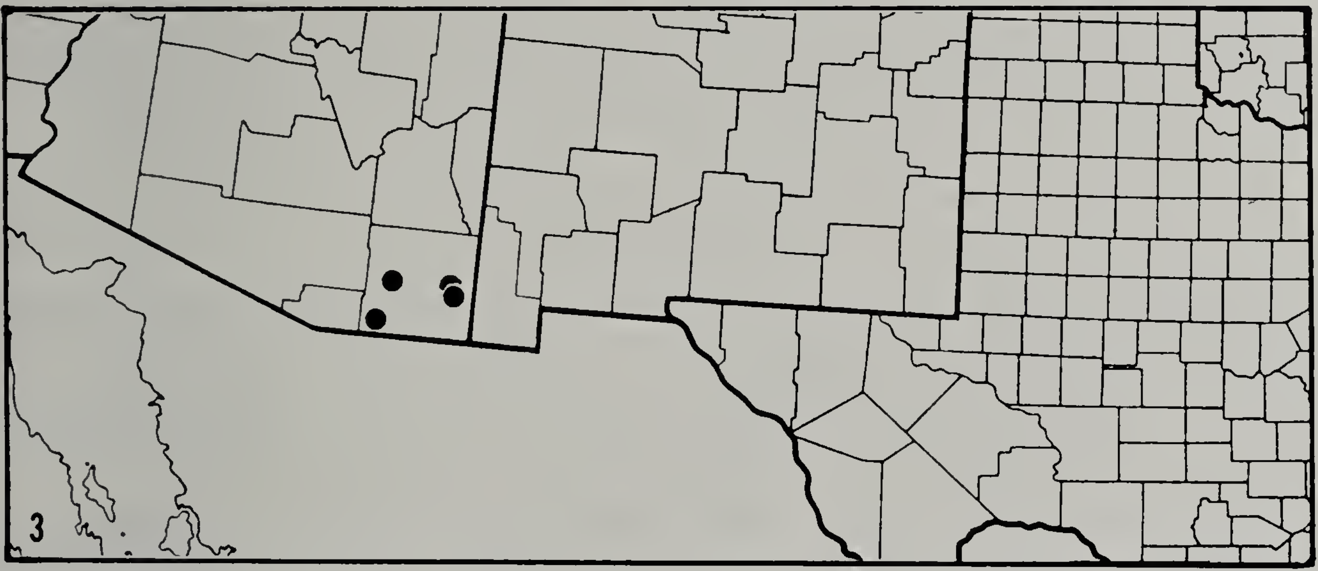
RELATIONSHIPS: The combination of punctured abdominal sternites and uniformly whitish pubescence on the pygidium will separate this very distinct species from all known to me except *Euparius lugubris* (Olivier) of eastern United States. The Olivier species has bicolored (black and white) (not tricolored) pubescence, and has a very different color pattern, the elytral disc being mostly black, not white.

Another species, *E. subtesselatus* Schaeffer, is sympatric with *E. pictus*, but is very different in color, being mottled browns and blacks and lacking the distinctive whitish patches. It is discussed below.

Euparius subtesselatus SCHAEFFER

Euparius subtesselatus Schaeffer, 1906:274. Holotype [USNM] from "Arizona".

This species is here recorded from Mexico and Texas for the first time. In morphology and facies it resembles *Euparius marmoreus* (Olivier 1795) and especially *Euparius oculatus* (Sharp 1891). The former species is widespread in eastern North America, the latter occurring from Japan to Formosa. The very coarse pronotal and ventral punctures, and narrower



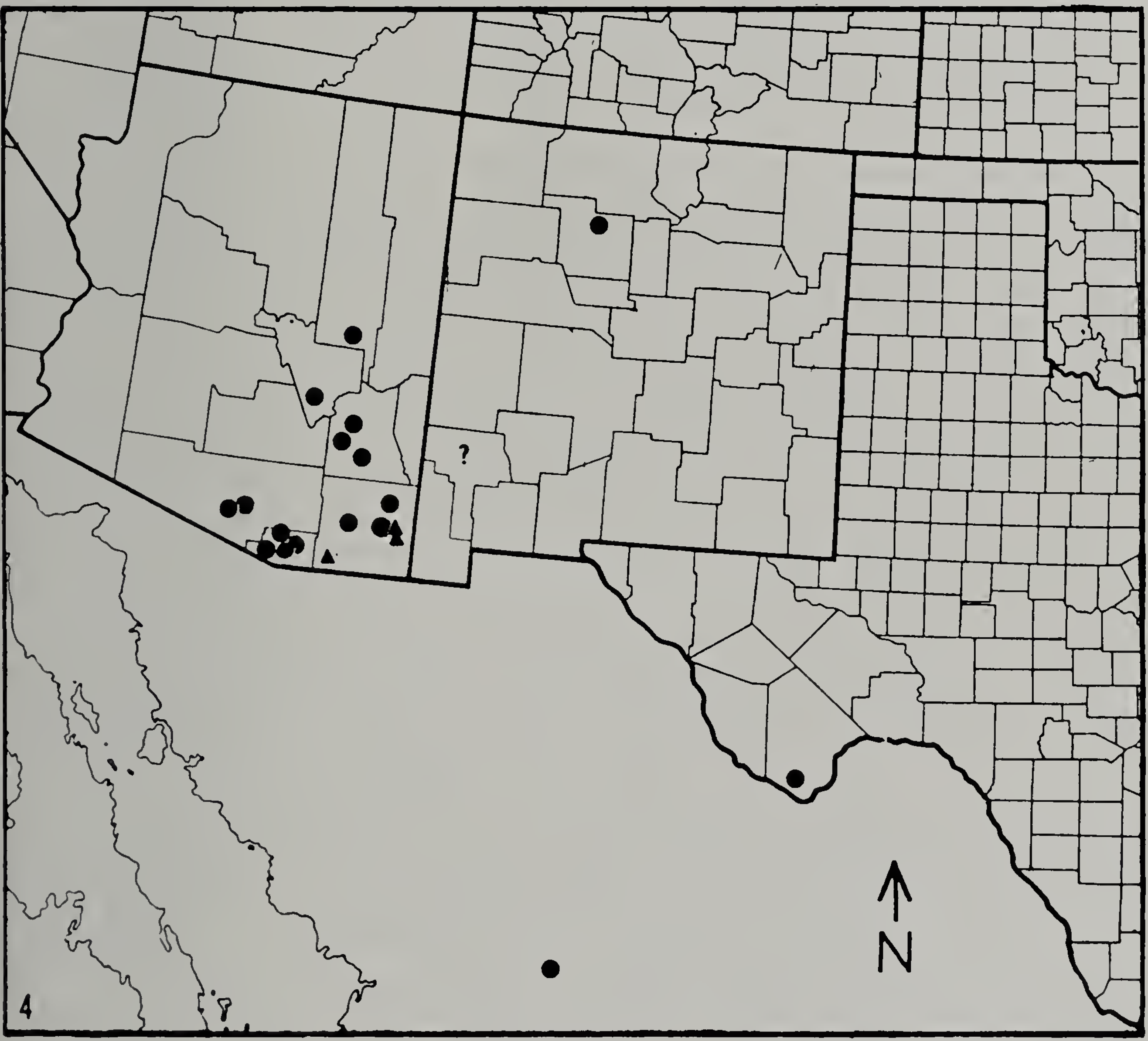


Fig. 3: Distribution of *Eugonus bicolor* n. sp. Fig. 4: Distribution of *Euparius subtesselatus* Schffr. (solid circles) and *Euparius pictus* n. sp. (solid triangles). ? = county record for *E. subtesselatus*.

form distinguish it from *E. marmoreus*, and the less convex eye and white first tarsal segment distinguish it from *E. oculatus*.

Euparius subtesselatus was omitted by Pierce (1930) in his studies of United States Anthribidae, and except for catalogues and incidental mention, appears unnoticed since Schaeffer's original description. Since the species is recorded only from Arizona and New Mexico without specific localities, it is appropriate to summarize the distribution data that have been accumulating (Fig. 4).

Specimens examined: Mexico, State of Chihuahua, 63 mi. W. Santa Barbara, 5500 ft., 20-VII-47, D. Rockefeller Exp., Cazier, [BDVC] (1); Valle de Olivos 5500′ 20-VII-47, D. Rockefeller Expd. Cazier, [AMNH] (1); State of Durango, San Juan del Rio, 5200′, 30-VII-47, D. Rockefeller Exped., Michener, [AMNH] (1). FIRST RECORDS FOR MEXICO.

United States: Texas, Brewster Co., Chisos Mts., 23-VI-61; 26-VI-61; 17-VII-46; D. J. &. J. N. Knull, [OSUC, BDVC] (6); 3-VII-62, W. E. & C. A. Triplehorn, [OSUC] (1); Oak Spr. Big Bend, 22-V-60, H. Howden, on dead willow [BDVC] (1). FIRST RECORDS FOR TEXAS.

New Mexico, Lincoln Co., 10-12 mi. W. Corona, nr. Red Cloud Canyon, Gallinas Pk., Hodges Cabin, 7000′, pinyon-juniper, light-trap 7:30 to 10:30, 28-VII-51, #B651 CCH, [AMNH] (1); Sandoval Co., Jemez Springs, 10-VII-54, Cazier & Gertsch, [AMNH] (5); Jemez Springs, 6200′, 16-VII-50, T. Cohn, P. Boone, M. Cazier, [BDVC] (1). Grant Co., no other data, in Fall collection, [MCZC] (1); September, 1916 [USNM] (2).

Arizona, no other data, HOLOTYPE male [USNM]. Cochise Co., Southwest Research Station, various dates between 29-VI-56 and 9-VII-56, H. and A. Howden, [HAHC, BDVC, UAIC] (11); also H. V. Weems, Jr., at light, 5-6000 ft., 28-VII-58, 2-IX-58, 7-IX-58, [FSCA, BDVC] (3); also O. L. Cartwright, 17-VII-56, 5400 ft. [USNM] (1); Chiricahua Mts., 5 mi. W. Portal, 25-VIII-58, C. G. Moore, [UCDC, BDVC] (5); Chiricahua Mts., D. J. & J. N. Knull, 14-IX-38; 12-VIII-52; 12-VII-53; 15-VII-53; 20-VII-53; 22-VII-53; 27-VII-53; 27-VII-53; 20-VII-55; 24-VII-55; 22-VII-57; 9-VII-59; 16-VII-59; 2-VIII-61; 28-VIII-62; 22-VII-65; 23-VII-67, [OSUC, BDVC] (17); NE slope Chiricahua Mts., 5000′, 29-VII-49, Werner, Nutting, [BDVC] (1); Portal, 7-VII-67, F. J. Moore, [OSUC] (1); Chiricahua Mts., Cave Creek, 5-6000 ft., 26-VIII-27, J. A. Kusche, [CASC] (1); Dragoon Mts., Cochise Stronghold, 29-VII-57, C. W. O'Brien, [CWOB, BDVC] (2); Cochise Stronghold, 4600′, blacklight trap, 6-IX-65, L. and C. W. O'Brien, [CWOB] (1); Douglas, 3-IX-36, W. W. Jones, [USNM] (1). Gila Co., Globe, 8-VII-49, Werner and Nutting, [BDVC] (1). Graham Co., Pinaleno Mts., Stockton Pass, 4-VIII-48, Nutting and Werner, [BDVC] (2); Geronimo, 6-VIII-48, Werner and Nutting, [BDVC] (1); Mt. Graham, Noon Cr., at light, 28-VII-54, F. G. Werner, [BDVC] (1). Navajo Co., 16 mi. SW. Showlow on U.S. rte. 60, 7000′, 10-VIII-48, G. E. Ball, [BDVC] (1). Pima Co., E. side Baboquivari Mts., Brown's Canyon, 29-30-VII-52, H. B. Leech and J. W. Green, [BDVC] (1); Baboquivari Mts., Brown's Canyon, 18-VIII-55, F. G. Werner and G. B. Butler, at light, [UAIC] (1); W. slope Baboquivari Mts., Baboquivari Canyon, 17-VII-49, F. Werner, W. Nutting, [CASC] (1); Santa Catalina Mts., Molino Basin, 4600′, at blacklight, 3-IX-65, C. W. O'Brien, [BDVC] (1). Santa Cruz Co., Patagonia, 5-IX-64, at light, C. D. Johnson, [CWOB] (1); Patagonia, VII-34, E. S. Ross [CASC] (1); 2 mi SW Patagonia, willow-cottonwood, 4050′, 30-VII-48 F. Werner and W. Nutting, [BDVC] (1); 5 mi SW Patagonia, 3700′, 25-VIII-50, T. Cohn, P. Boone, M. Cazier, [BDVC] (1); W. slope, Patagonia Mts., 4400′, 27-VII-49, F. Werner, W. Nutting, [BDVC] (1); Nogales, 7-VII-49, D. J. & J. N. Knull, [BDVC] (1); Santa Rita Mts., N. slope, Madera Canyon, oak-pine-juniper zone, 5380′, 31-VII-48, F. Werner and W. Nutting, [BDVC] (1); Madera Canyon, 5100′, Bog Spring Cp. Grd. 10-26-VII-64, D. Davis, [USNM, BDVC] (2); Tumacacori Mts., Sycamore Canyon, Yank's Spring, 3-VIII-52, H. B. Leech and J. W. Green, [BDVC] (1); Peña Blanca Lake, White Rock Camp, at blacklight, 14-IX-64, L. and C. W. O'Brien, [CWOB, BDVC] (2).

EUGONUS SCHÖNHERR

Eugonus Schönherr, 1833:144. Type: *Eugonus vigatus* Gyllenhal, 1833, by original designation and monotypy. See Valentine (1960:61) for synonymy and differentia.

There are presently 8 described species, of which 7 occur from Brazil to Nicaragua. The eighth species, *Eugonus subcylindricus* Fahraeus (1839) occurs from Argentina to southern Mexico. In 1960 I reported a single specimen of a new species from southeastern Arizona, which appeared close to *E. subcylindricus*, but 1 specimen made it impossible to judge the constancy of the differences. I have now seen 22 Arizona specimens from 5 collections, and describe the new species below.

Eugonus bicolor Valentine, NEW SPECIES
(Fig. 2, 3)

HOLOTYPE, male, labeled "Chiricahua M[ountains] VII-30-59 Ar[izona]". "D. J. & J. N. Knull Collrs." "Drawn by D. M. Dennis." [OSUC]. According to Prof. Knull, the actual collection site is in Cave Creek Canyon about 2 mi. se. Portal, at about 5,000 ft., in Cochise County.

DIAGNOSIS: Dorsal pubescence bicolored, mostly dark brown with straw-colored areas forming scattered irregular spots; legs without prominent markings; tibiae longitudinally angulate; venter punctate; metasternum with a deep post-median pit; rostrum and interocular area rugate-reticulate; pronotum with many irregularly spaced punctures, densest near the base.

DESCRIPTION: holotype (variation in parentheses); length, head excluded, 6.5 (5.0-7.25) mm; form elongate, parallel-sided, evenly convex; derm varying shades of reddish-brown, dorsal pubescence mixed dark brown and pale straw, the venter and legs slightly more gray. *Head*: with a weak median carina on rostral apex; entire face densely punctate, the intervening areas convex and forming fine longitudinal reticulate rugae; scattered pale pubescence vaguely concentrated around eyes; antennae very short, not reaching humerae (even with head deflexed), first 2 segments thicker than those following, II slightly longer than III, III to VIII progressively shorter, club abrupt, asymmetrical, almost as long as III to VIII combined. *Prothorax*: widest at anterior third; evenly convex; transverse carina entire, almost basal, meeting lateral carina in an abrupt curve, the resulting angle about 90°, lateral carina continuous to apex where it protrudes as a small flattened shelf-like tooth; dorsum densely and irregularly punctate, most concentrated at basal third and laterally where punctures are separated by a puncture diameter or less, least concentrated and obscure on apex; entire prosterum with large punctures except along both sides of the pleural (supra-coxal) suture, the suture not quite extending to the lateral carina; no deep groove along the ventral apical margin; intercoxal process with a thick curved ridge between the coxae, no long transverse post-coxal ridge nor lamella. *Scutellum*: small, cordate, flush with elytral margin, densely pale pubescent. *Elytra*: elongate, parallel-sided, base almost straight, slightly wider than prothoracic base; raised basal margin continuous around prominent, obtusely-angled shoulders; striae barely impressed except the apical portion of the first, punctures small and deep, spaced differently on each stria but usually separated by more than the diameter of a puncture; interspaces faintly convex; extreme apex with just a hint of a marginal swelling beside the sutural angle; pale pubescence most evident in irregular spots on basal third, and in larger patches above apical declivity, these incomplete across the suture. *Pygidium*: with wide median line and narrow periphery reddish brown, remainder gray pubescent; disc with many small very shallow punctures. *Abdomen*: with first 4 sternites each deeply and closely punctate along anterior margin, fifth sternite with traces of basal punctures. *Pterothorax*: with large deep punctures; metassternum with raised rim but no deep groove along hind margin of mesocoxae, and a midventral groove accentuated by a deep elongate pit, the groove ending in another pit between the metacoxae. *Legs*: with femora unicolored, short, greatly swollen, faintly and shallowly punctate; tibiae unicolored, short, flattened, angulate, the apices (especially middle and hind pair) almost rectangular in cross section; tarsi unicolored, short, apical half of first segment convex, of second segment concave, third short, almost hidden from above, deeply immersed in the second and with the lobes short and close together, fourth vertical, small, fifth longer, depressed, widest in the center then slightly narrowed to apex, claws long with a strong antemedian tooth. *Male*: metasternum without paired tubercles anterior to the hind leg insertion; abdominal sternites II, III, IV each with a small median tuft of fine golden bristles; mid tibia with a small apical incurved tooth on lower margin; ventral apex of hind tibia and first two tarsal segments with a few long erect fine golden bristles.

Specimens examined: total 22, all from Cochise County in extreme southeastern Arizona. Holotype male, allotype female, 5 female and 8 male paratopotypes all collected in [Cave Creek Canyon] Chiricahua Mountains, D. J. and J. N. Knull, on the following dates: 26-VII-52 (1 male), 12-VIII-52 (1 male), 27-VIII-53 (1 female), 22-VII-57 (allotype female), 27-VII-57 (1 female), 16-VII-59 (1 male), 30-VII-59 (holotype male and 2 females), 7-VIII-59 (2 females), 15-VIII-59 (1 male), 18-VII-61 (1 female), 25-VII-61 (1 female), 2-VII-61 (1 male); holotype and allotype in OSUC, paratopotypes in OSUC, AMNH, USNM, BMNH, CWOB, MCZC BDVC. Three specimens are known from the Southwestern Research Station of the American Museum of Natural History also in the Chiricahua Mountains, as follows; S.W.R.S., 5 mi. W. Portal, 5400 ft., Cochise Co., Ariz. 15-VII-59, M. Statham [BDVC] (1 male paratype); SW. Res. Sta., Portal, Ariz. 9-VII-56, H. & A. Howden, light, [HAHC] (1 male paratype); also 5-VI-56, [BDVC] (1 female paratype). There are also paratypes from Cochise Stronghold, Dragoon Mts., 13-VIII-1958, C. W. O'Brien, at light, [BDVC] (1 male paratype); Huachuca Mts., [Miller Canyon, el. about 6500 ft. according to Professor Knull], D. J. & J. N. Knull Collrs., 19-VII-50, (2 male paratypes); also 20-VII-36, (1 female paratype) [OSUC, BDVC].

RELATIONSHIPS: This species is closest to *E. subcylindricus*, differing in the nature of the rostral sculpture, pronotal punctuation, and reduced color pattern. *Eugonus subcylindricus* is the most widespread species in the genus; however, specimens from Argentina, Brazil, Paraguay, Guianas, Nicaragua, and Mexico show no trend towards *bicolor* from Arizona. It appears that the 2 forms are discontinuously different, and I therefore refer them to separate species. The 3 species of *Eugonus* in North and Central America can be keyed by the following features:

1. Metasternum with a deep post median pit separate from the apical intercoxal pit 2

1'. Metasternum without a deep post median pit (Nicaragua) .... *decorus* Jordan

2. Interocular area densely punctured; pronotal base almost im punctate, with a few scattered punctures on either side of center (Argentina to S. Mexico) .... *subcylindricus* Fahraeus

2'. Interocular area densely rugate; pronotal base densely punctate (SE. Arizona) .... *bicolor* n. sp.

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LITERATURE NOTICE

Natural History Collections. Past. Present. Future.—A Symposium of the Biological Society of Washington. Proc. Biol. Soc. Wash. 82:559-762, Nov. 1969. $4.00, paper. (Available from the Society, c/o National Museum of Natural History, Smithsonian Institution, Washington, D. C. 20560.)

The scope of this volume is illustrated by the Table of Contents: Art and science as influences on the early development of Natural History collections, by P. C. Ritterbush; Vertebrate fossil collections—a fragmentary document, by N. Hotton; Fossils—the how and why of collecting and storing, by E. L. Yochelson; The role of the National Parasite Collection in veterinary parasitology, by W. W. Becklund; The National Collections as biological standards, by R. Cowan; Does Anthropology need museums?, by W. C. Sturtevant; The role of museum collections in ornithological research, by R. L. Zusi; Malacological collections—development and management, by J. Rosewater; Automation in museum collections, by R. B. Manning; The herbarium: past, present, and future, by S. G. Shetler; Summary, by D. Cohen and E. Lachner.

A paper entitled "Entomological collections—the dilemma of success," was presented by Donald Duckworth but is not included as part of the publication.—R. E. Woodruff.

BOOK REVIEW

Wildlife Crisis by HRH Prince Philip (Duke of Edinburgh) and James Fisher. 1970. Cowles Book Co., Inc., 488 Madison Ave., N. Y. 10022. 265 p., 8 maps, 31 colored plates, 105 black & white fig. Cloth, $14.95.

This is a beautifully produced, fantastically illustrated, and relevant source book of extinct and endangered birds and mammals of the World (as of Dec. 31, 1969). The list of species was compiled by the International Union for Conservation of Nature and Natural Resources (IUCN). The royalties from the book's sale go to the World Wildlife Fund. In addition to the prestigious authors listed above, there are forewords by HRH Prince Bernhard (Netherlands) and noted author Peter Scott and an epilogue by former U.S. Secretary of Interior Stewart L. Udall.

Aside from the beauty of the book, it is of interest to our readers for other reasons. HRH Prince Philip stated in the Preface:

> "It is worth remembering that most of the world's flora and fauna were catalogued and classified by Europeans. I suspect that the rest of the world still looks upon dedicated bird watching, or the collection of everything from Acephalan molluscs to Zabrus beetles as a form of madness."

I am sure that the 500+ members of our Coleopterists Society would take exception to this statement. Europeans have played an important role in describing the world's plants and animals, due in great part to their colonization of large parts of the globe. However, I believe that the concern, over and conservation of, our wildlife is not confined to Europeans.

The number of extinct and vanishing species of birds and mammals listed in the book is staggering. Of special interest to coleopterists is the fact that many of these vertebrates have specific beetle faunas associated with their nests, burrows, and dung. There are a great number of invertebrates which have already become extinct or are in danger because of this close association with endangered vertebrates. The study of these associated faunas should take high priority in our research.—R. E. Woodruff.

THE GENERA *PODISTRA* AND *PSEUDOABSIDIA* IN NORTH AMERICA (COLEOPTERA: CANTHARIDAE)[1]

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Abstract

The *Podistra* group of the Cantharini in North America now consists of 3 species, 2 of which were previously listed under *Cantharis*, and the third is described here as new: *Podistra* (*Hemipodistra*) *insipida* (Fall), NEW COMBINATION for *Cantharis* (*Absidia*) *insipida* (Fall); *Pseudoabsidia sierrae* (McKey-Fender), NEW COMBINATION for *Cantharis sierrae* McKey-Fender; and *Pseudoabsidia sanbernardensis* Fender, NEW SPECIES, from Lake Arrowhead, California.

Fall (1907) described *Telephorus insipidus* from a single male collected in New Mexico. In his description he stated that all claws of the male were simple. McKey-Fender (1950) tentatively placed the species in the subgenus *Absidia* of the genus *Cantharis*. She conceded that the Coleopterorum Catalogue put *Absidia* as a subgenus of the genus *Podistra*, but she preferred to retain it in *Cantharis* pending future studies of the generic position. Unfortunately she never pursued it further. She described a new species as *Cantharis* (*Absidia*) *sierrae*. At that time, she had before her 2 males of a species that she provisionally determined as *C.* (*Absidia*) *insipida* (Fall), the type of which she had not seen. Up to the present time, our knowledge of the group has been confined to Fall's types of *insipida*, McKey-Fender's type and paratype of *sierrae*, and the 2 specimens she assigned to *insipida*, all males.

The collection of a series, including 2 females, of *insipida* invited an investigation into the proper position of that species as well as that of *sierrae*. This series was collected at The Pines Forest Camp, Lincoln Nat. For., New Mexico, 13-VII-68 by my son William and me. I have examined the type of *insipida* and confirmed that the series is conspecific with it. A female of *sierrae* is before me, collected at Camp Angelus, San Bernardino Mountains, California, 1-VII-70, Karl Stephan.

This investigation required the translation and study of the publications of Dr. W. Wittmer, Natural History Museum, Basel, Switzerland and those of Dr. N. Magis, University of Liege, Liege, Belgium, as well as correspondence with each. They were both most cooperative and helpful.

The *Podistra* group of the Cantharini may be recognized by the head rather long behind the eyes; eyes remote from the pronotum; mandibles simple; males slender; apical segment of the maxillary palpi with the inner angle obliterated; tarsi slender, third tarsal segment apically emarginate, insertion of the fourth segment ante-apical; all claws of both sexes simple or, at most, anterior claws of protarsi of males only with a short acute tooth, all other claws and all those of the female simple.

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[1] This study was supported by National Science Foundation grant GB-6283X.

KEY TO THE PODISTRA GROUP

1. All tarsal claws of both sexes simple............Genus *Pseudoabsidia* Wittmer
1′. Anterior protarsal claw of male with a blunt basal tooth, all other claws simple; all claws of female simple...Genus *Podistra* Motschulsky.................. 2

2(1′.) Wings and elytra of both sexes strongly abbreviated..Subgenus *Podistra* s. str.
2′. Wings and elytra of male entire...3.

3.(2′.) Wings and elytra of male entire, of female greatly abbreviated.................................... ....Subgenus *Hemipodistra* Ganglbauer
3′. Wings and elytra of both sexes entire................Subgenus *Absidia* Mulsant

Despite Fall's statement that all claws are simple and McKey-Fender's acceptance of this, the males of *insipida* have the anterior claws of the protarsi with a blunt basal tooth. This places it in the genus *Podistra. P. sierrae* of McKey-Fender has all claws simple in both sexes as has the species she provisionally placed as *insipida*, placing them in the genus *Pseudoabsidia.*

McKey-Fender mentioned that the female of the European *Pseudoabsidia prolixa* (Mark.) is said to have the elytra greatly abbreviated. Both Magis and Wittmer agree that the female of the species has entire elytra.

Podistra (Hemipodistra) insipida (Fall), NEW COMBINATION
Telephorus insipidus Fall 1907:235.
Cantharis (Absidia) insipida, McKey-Fender 1950:77-78.

Dusky testaceous, sides of head behind antennae somewhat darker, eyes black, apical margins of abdominal sternites paler, pubescence brassy.

Male: Slender, parallel, length 8.5 to 10 mm, width at elytral humeri 2 to 2.5mm. Head wider than pronotum; eyes large and prominent; clypeus short, shining, very finely sparsely punctured, anterior margin oblique either side; head behind antennae more coarsely punctured; antennae filiform, slender, extending nearly to tips of elytra, second segment not quite half as long as third, segments 4 to 11 fully 5 times as long as wide. Pronotum longer than broad, shining, very finely sparsely punctured, a little more coarsely so along anterior margin; sides subparallel, shallowly sinuate toward anterior and basal margins, basal angles obtuse but evident, anterior angles wanting; disc with a finely impressed longitudinal median line, line not eroded, tumid each side posteriorly; sides rather deeply broadly impressed anteriorly, posterior margin narrowly reflexed; lower margin of pronotal epipleurae exserted towards middle to the extent that they are visible from directly above. Scutellum linguiform, finely, rather closely punctured. Elytra entire, covering abdomen, about 3.25 times as long as their combined widths at the humeri, about one-half wider than the pronotum, finely scabrous; elevated costae very fine and indistinct. Thorax beneath shining; finely sparsely punctured. Abdominal sternites more coarsely punctured and with fine transverse rugae. Tarsi slender; anterior claw of protarsi with a short blunt basal tooth (Fig. 1), all other claws simple (Fig. 2). Pubescence fine and inconspicuous, dual on the elytra with denser short depressed hair and sparser long erect hairs.

Female: More robust than male. Length 9.5 to 11mm, width at elytral humeri 2.5 to 3mm. Differing from the male in: eyes much smaller and less prominent; antennae shorter, extending to about base of second visible abdominal sternite, segments 4 to 11 about 3 times as long as wide; pronotum wider than long, wider than head, anterior angles evidenced although broadly rounded, exserted lower margin of epipleurae barely visible from above; elytra and wings greatly abbreviated, half again as long as combined widths at the humeri, leaving apical two and a half abdominal tergites exposed; last abdominal sternite as shown (Fig. 3); tarsi shorter, all claws simple.

Neallotype female: NEW MEXICO: The Pines Forest Camp, Lincoln Nat. For., 8750 feet, 13-VII-68, K. M. and W. M. Fender, [Cal. Acad. Sci.].

Pseudoabsidia sierrae (McKey-Fender), NEW COMBINATION
Cantharis (Absidia) sierrae McKey-Fender 1950: 76-77.

Piceous to black, basal antennal segment, pronotum, and scutellum yellow to orange yellow, head yellowish with sides behind eyes piceous, pubescence dusky testaceous.

Male: Slender, length 6.5mm, width at elytra humeri 1.5mm, antennal length 4mm. Head short in front of eyes, anterior margin of clypeus biarcuate, shining, front finely, sparsely punctured, closely more coarsely punctured behind; antennae moderately stout, less than two-thirds body length, second segment about one-third length of third, segments 4 to 7 less than 4 times as long as wide; eyes large, separated by a distance slightly greater than length of an eye. Pronotum subtransverse, slightly wider than head including eyes, posterior angles nearly rectangular, sides slightly wider anteriorly, feebly sinuate, slightly constricted behind indistinct and broadly rounded anterior angles and just anterior to basal angles; anterior margin shallowly convex medially; basal margin very finely convex, margins somewhat reflexed; disc shining, very finely sparsely punctured, tumid either side towards base, a moderately deep median longitudinal line between tumidities, pubescence very fine and sparse. Elytra moderately slender, combined width at the humeri nearly one-half again width of pronotum; scabrous, costae rather feebly elevated and dim, margins somewhat thickened; pubescence rather sparse, erect, dual, denser short hairs and sparser long hairs. Body beneath finely sparsely punctured, thorax shining, abdomen dull. Tarsi slender, all claws simple.

Female: similar to male, a little more robust, length 6.5mm, width at elytral humeri 2mm; eyes smaller and less prominent, separated by nearly twice the length of an eye; antennal segments 4 to 11 about 2.5 times as long as wide. Pronotum a little more transverse, nearly three-fourths as wide as elytra at the humeri. Elytra entire. Apical margin of last abdominal sternite as illustrated (Fig. 4). All claws simple. In the specimen at hand, basic color black, head and pronotum dark flavous, head feebly darkened at sides behind eyes, basal antennal segment pale medially, becoming black at both ends.

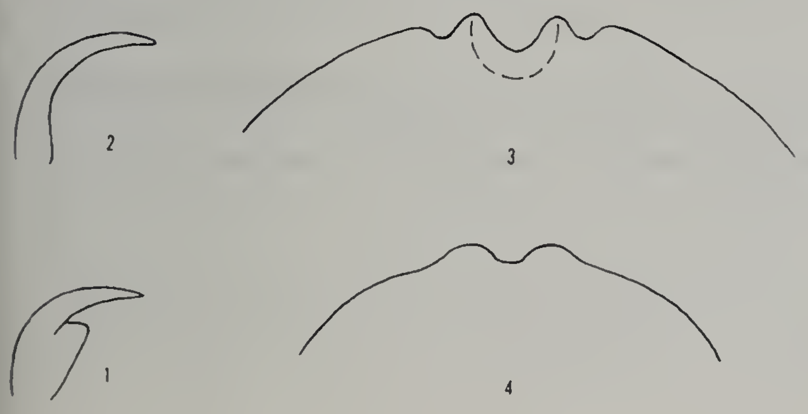

Fig. 1-3: *Podistra (Hemipodistra) insipida* (Fall); 1) toothed anterior protarsal claw of male, 2) simple claw. 3) apical margin of last sternite of female. Fig. 4: *Pseudoabsida sierrae* (McK.-Fend.), apical margin of last sternite of female.

Neallotype female: CALIFORNIA: Camp Angelus, San Bernardino Mts., 1-VII-70, Karl Stephan.

Pseudoabsidia sanbernardensis Fender, NEW SPECIES.

Cantharis (Absidia) insipida of McKey-Fender (not Fall) 1950:77-78.

Dusky testaceous; head in front of antennae and at sides behind eyes, all but basal segment of antennae, elytra, and tarsi a little darker, elytra becoming nearly piceous at the apices. Pubescence brassy.

Male: slender, length 5.25mm, width at elytral humeri 1.3mm. Head short in front of eyes, anterior margin of clypeus biarcuate, clypeus shining and finely sparsely punctured; eyes large and prominent, separated by a little more than length of an eye; antennae filiform, slender, extending nearly to tips of elytra, second segment about one-third length of third, segments 4 to 11 somewhat compressed, in lateral view appearing about 4 times as long as wide, in dorsal view over 5 times as long as wide; head behind antennae closely coarsely punctured. Pronotum shining, longer than wide, narrower than head including eyes, anterior angles obliterated, sides evenly curving into similarly arcuate and shallowly reflexed anterior margin; sides parallel and feebly bisinuate, pronotum constricted slightly just behind anterior angles and just anterior to basal angles, basal angles nearly rectangular, feebly prominent, basal margin narrowly convex and rather deeply guttered; disc finely sparsely punctured, tumid each side towards base, median longitudinal impressed line short and not eroded. Scutellum elongate, subtriangular, apically rounded, sparsely more coarsely punctured than pronotum. Elytra combined half again as wide as pronotum; coarsely sparsely punctured basally, becoming nugose beyond basal fourth; costae, if present, very evanescent. Thorax beneath shining, finely sparsely punctured. Abdominal sternites dull, finely sparsely punctured. Tarsi long and slender, all claws simple. Pubescence fine and sparse, dual on elytra with more dense erect short hairs and sparser erect long hairs.

Female: Unknown.

Holotype male: CALIFORNIA: Lake Arrowhead, 6-VII-41, G. P. Mackenzie, [Cal. Acad. Sci.]. *Paratypes*: CALIFORNIA: San Bernardino Co. Forest Home 18-VII-25; San Bernardino Co. (1), Camp Baldy, 26-VI-56

This species differs from *Pseudoabsidia sierrae* in color, the longer antennae, and the pronotum being longer than broad.

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THE PUPATION OF *CALOPTERON TERMINALE* (SAY) (COLEOPTERA: LYCIDAE)

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Abstract

Prior to pupation, the larva of *C. terminale* attaches its caudal end in a vertical position to a suitable substrate. The larval cuticle splits along the dorsolateral margins and the pupa remains within the exuvium. Duration of the pupal stage is 1 week.

Larvae of the netwinged beetle, *Calopteron terminale* (Say), were collected in the W. K. Kellogg Forest in Kalamazoo County, Michigan on 9 July, 1971, as they crawled over the exposed surface of a moist decaying fallen oak log. This species apparently works its way from beneath bark of decaying logs where it has spent its larval stage to seek a place in the open environment for pupation. Exuviae and pupae have previously been observed on the exposed surface of logs, leaves, and other forest litter.

Several larvae were placed in a covered plastic container with a small amount of decaying wood, moist leaves, and soil, and kept at room temperature. The discussion that follows is based upon observations of these larvae and the ensuing pupae.

Prior to pupation, the larvae attaches its caudal end in a vertical position by a secretion (apparently from the proleg-like tenth abdominal segment). The secretion hardens to a clear cement-like substance. The larva remains in this quiescent prepupal stage from 2 to 4 days. Then the cuticle splits along each dorsolateral margin, usually from the head to the seventh abdominal segment. The entire exuvial dorsum remains attached at the caudal 3 or 4 abdominal segments and sometimes also at the head.

The pupa (Fig. 1) has an elongate body, 11-16 mm long, dirty white in color with some brown. *Head*: small and inconspicuous, partially covered by the pronotum; antennae prominent with numerous minute tubercles on the lateral and apical margins of segments 3-11.

Pronotum: with 6 elongate tubercles (4 along the anterior border which are directed anteriorly, and 1 on each of the posterior angles which is directed vertically). *Mesonotum*: with 2 small subcylindrical tubercles, their length subequal to their width, situated mesally on the posterior edge. *Metanotum*: with a single mesally located protuberance.

Abdomen: segments 1-8 (using the abdominal terminology of Rozen 1959) bear 4 tubercles (1 lateral marginal tubercle and 1 pleural tubercle on each side). The hook-shaped pleural tubercles become progressively shorter from the first to the eighth abdominal segment. The degree of hooking is much less pronounced in the tubercles on the last few segments. The ninth abdominal segment gives rise to elongate, posteriorly directed, apically hook-like urogomphi. The hook-like apices are covered with large numbers of very minute spine-like protuberances.

The quiescent pupa remains within the exuvium. The hook-like apices of the urogomphi are attached by a cement-like substance to the inner

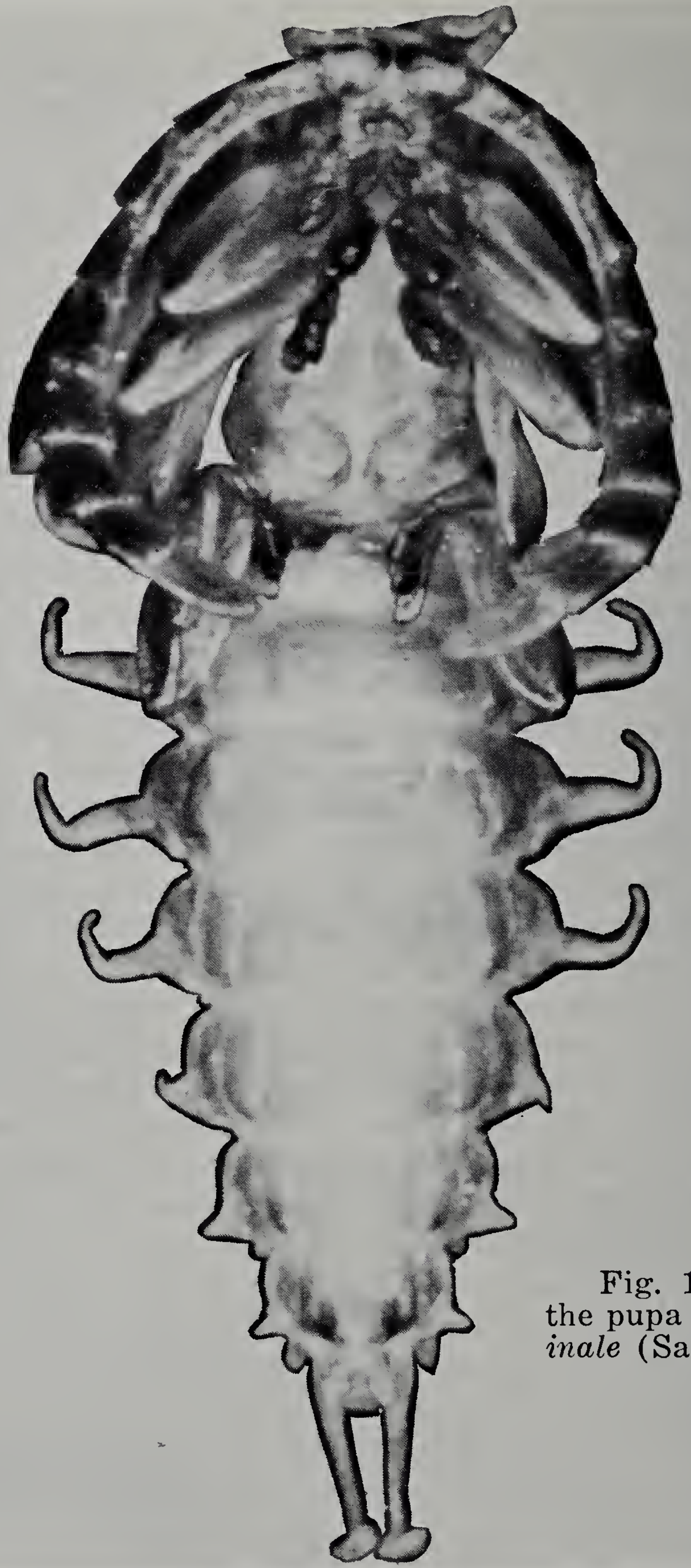

Fig. 1. Ventral view of the pupa of *Calopteron terminale* (Say).

exuvial wall of the ninth and tenth abdominal segments. Adults emerged 6 to 8 days later, commonly in 7 days.

By remaining within the larval exuvium as a pupa, *C. terminale* is afforded many of the same protective advantages as those of a pupal case, pupation under bark, or in a leaf. The adult is also able to circumvent the necessity of chewing its way from beneath the bark of a log. The rapacious mandibles of the adult are far more suited for the capture of prey and are morphologically incapable of chewing.

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THE EYELESS EUROPEAN SOIL COLYDIID, *ANOMMATUS DUODECIMSTRIATUS*, IN NORTH AMERICA (COLEOPTERA: COLYDIIDAE)

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ABSTRACT

The presence of *Anommatus duodecimstriatus* (Müller) in North America at Rochester, New York, is confirmed. It is an eyeless, wingless, and probably parthenogenetic species, native to and widespread in Europe. Its introduction to Rochester was with soil accompanying plants. An extensive sampling program of North American forest litter has not shown the species to be established elsewhere.

Cooper (1962) reported the existance of a colony of *Anommatus duodecimstriatus* (Müller) in North America at Rochester, New York. This species is widespread in Europe, and is an eyeless and wingless soil inhabitant. Its presence in Rochester was explained as a result of its accidental introduction in soil accompanying plants used for nursery stock. The purpose of this note is to confirm the above determination and to provide additional thoughts on the species.

The genus *Anommatus* has been revised recently by Dajoz (1966). He found it to contain 49 species of which all but 2 have very local distributions in Europe. I have used Dajoz's revision to verify Cooper's determination of *A. duodecimstriatus* and its presence in North America. This is based upon a new collection of 32 specimens taken with Berlese funnels in April, July, and August of 1967 and 1970 by William B. Muchmore of Rochester.

Cooper suggested that the species may be parthenogenetic based upon dissections of 9 specimens which all proved to be females. The others in his collection of 22 were not dissected. My larger sample is composed entirely of females. This increasing evidence of parthenogenesis is not now surprising in view of the fact that Dajoz examined hundreds of specimens and found no males. Thus, this species can be added to the list of beetles of various families in America that are probably parthenogenetic, but for which the conclusive laboratory studies have not been performed (Smith 1971).

In parthenogenetic species the potential for colonization and range expansion is increased because only the female need move or be moved to a new site. Several species of flightless, European, soil-associated weevils, shown by laboratory study to be parthenogenetic, have undoubtedly benefited from this increased colonization potential and have become established in eastern Canada after transport in ship ballast (Smith 1971). This potential in *A. duodecimstriatus* undoubtedly accounts for its colonization success in Rochester, as well as over most of its range in Europe, a range which is probably largely one resulting from accidental transport of beetles in soil accompanying plants. That the species can build up large populations, once established, is demonstrated by the estimate of 460,000 per acre in an old field near London, England (work of Baweja, cited in Dajoz).

Cooper suggested that the species may be expected at additional North American localities. In my Tullgren funnel sampling program in the past 5 years I have processed over 4 metric tons of sifted soil and litter from eastern North American forests. I have not found *A. duodecimstriatus*, although other blind Colydiids have been collected, especially in Mexico (deposited in Field Museum, Chicago). If the species is established elsewhere in North America it is probably closer to cities or in more disturbed environments than I have sampled. This should not be surprising because the natural rate of range expansion from a propagule colony should not be expected to be high for an eyeless and wingless soil inhabiting beetle.

ACKNOWLEDGEMENTS

Support for my Tullgren funnel sampling of forest litter from 1966-1969 was from NSF grants GB 3167 and GB 7346 to the Evolutionary Biology Committee, Harvard University, Professor Reed C. Rollins, principal investigator; in 1971, from a systematic operating grant to Dr. H. F. Howden of Carleton University from the National Research Council of Canada. I also thank Dr. Muchmore for giving me the above *Anommatus* collections.

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BOOK REVIEW

Insecta Helvetica Catalogus. 2. *Coleoptera, Scarabaeidae, Lucanidae,* by V. Allenspach. 1970. 186 p., 13 maps. Published by the Schweizerischen Entomologischen Gesellschaft. Entomologiches Institut der ETH, Universität-Strasse 2, 8006 Zurich, Switzerland. Paper, 33 Swiss francs ($8.25 at the current exchange rate).

This volume is only the second in this series of catalogues of the Swiss fauna, but several others are in preparation. It really contains more information than most catalogues: distribution records both Swiss and general, seasonal data, collectors, depositories, and biological data. Considerable historical data, including nomenclatural and faunal changes, are discussed since Heers' first 1837 paper on the Swiss fauna. The manuscript was completed in January 1968. Many of the records are presented in abbreviated form, but they are keyed to lists in the introduction. There are 42 private collectors listed and the repositories for their collections. There is a 10-page, double column gazetteer showing the "Kantone", elevation in meters, and the zone. A table compares the fauna in 1900 (178 species) with that in 1967 (173 species). There is an extensive bibliography, but it does not list page citations. It is printed on good quality paper with clear type styles. Such catalogues provide the foundation from which future taxonomic, biological, and ecological studies proceed. It is unfortunate that there are so few modern, quality publications such as this one.—R. E. Woodruff.

A NEW ALPINE SPECIES OF *UNAMIS* FROM CALIFORNIA (COLEOPTERA: STAPHYLINIDAE)

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Abstract

Unamis giuliagnii n.sp. is described from the edge of ice fields at 11,300 ft. elevation, near Finger Lake, Inyo Co., California. The species is illustrated and a key is provided to distinguish it from the 4 previously known species.

The genus *Unamis* was erected for the single species *truncata* (Casey, 1893) from California. Fall (1922) added a second California species. Hatch (1957) described 2 more species from the Pacific Northwest and reviewed the genus. Another species is described below.

Little is known of the habits of the species of *Unamis* except that they are found under cover near water. Their life histories are unknown.

The species of *Unamis* can be distinguished from other members of the tribe Anthophagini by the following combination of characters: first segment of posterior tarsi about as long as last segment, last segment of maxillary palpi about 4 times as long as penultimate, head with well impressed nuchal contriction (Moore 1966).

Key to the Species of *Unamis*

1. Head, pronotum, and elytra alutaceous; legs and antennae entirely black .... *giulianii* Moore and Legner, n. sp.
1′. Head, pronotum, and elytra not alutaceous .... 2.

2(1′). Legs and antennae rufo-testaceous .... *fulvipes* Fall
2′. Legs and antennae piceous, extreme bases of legs vaguely paler .... 3.

3(2′). Head with oblique frontal impressions connected by a somewhat less impressed transverse impression .... *bjorkmanae* Hatch
3′. Head with oblique frontal impressions not connected by a transverse impression .... 4.

4(3′). Elytra nearly parallel .... *truncata* (Casey)
4′. Elytra distinctly inflated behind .... *columbiensis* Hatch

Unamis giulianii Moore and Legner, NEW SPECIES

Holotype, male.—Color black throughout. *Head*: a little wider than long; clypeus somewhat produced in front; clypeal suture well impressed; anteocellar impressions foveaform; nuchal constriction deep; ocelli hardly discernible; eyes occupying about a third of the side of the head; tempora very short, considerably less prominent than eyes; surface finely microreticulate and very finely punctured; antennae distinctly longer than head and pronotum, first segment about twice as long as wide, second segment a little shorter and a little narrower than first, third segment a little narrower and slightly longer than second, third segment through tenth segment

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[1] Staff Research Associate and Associate Professor of Biological Control, respectively.

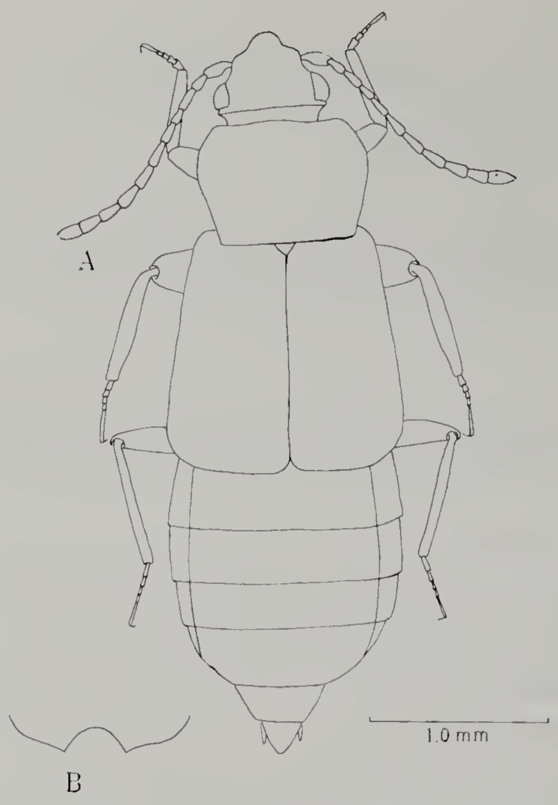

Fig. 1: *Unamis giulianii* Moore & Legner, holotype male; A) dorsal view; B) apex of 6th sternite.

of about equal length, each slightly wider than preceding, tenth segment about twice as long as wide, eleventh segment distinctly wider and longer than tenth, ovoid with the tip gradually pointed, with one surface concave.

Pronotum: seven-tenths as long as wide, widest near anterior third; apex nine-tenths as wide as base; apex and base straight; apical angles broadly rounded; sides evenly rounded in front, convergent and nearly straight from near the middle to the slightly obtuse basal angles. Surface with a distinct foveaform impression each side, the side distinctly reflexed from the impression to the base; otherwise evenly convex, microreticulate; and feebly punctured throughout, the punctures mostly separated by about their diameters.

Elytra: conjointly nineteen-twentieths as wide as long, widest one-tenth of distance from apex, humeral angles narrowly rounded, sides straight and divergent to the broadly rounded outer apical angles, inner apical angles narrowly rounded. First abdominal segment completely covered by elytra. Mesosternum longitudinally carinate, with a pronounced tumidity each side of carina. Surface strongly reticulate, distinctly more coarsely punctured than pronotum.

Abdomen: with exposed segments distinctly longer than elytra, about as wide as elytra; surface microreticulate, punctures sparse and exceedingly fine. Under surface sculptured much as above. Sixth ventral segment with the posterior margin emarginate in central three-tenths, the emargination oval, not quite as deep as wide, sides of emargination slightly produced and angulate.

Length: 4.0mm.

Specimens examined: Holotype, near Finger Lake, Inyo County, California, August 10, 1971, 11,300 feet, under rocks at edge of ice field, Derham Giuliani [California Academy of Sciences]. *Paratype*: one male same data as holotype.

This insect is remarkable in its uniformly black color. Even the mouthparts and tarsi are as densely pigmented as the rest of the body. It is distinct from all other members of the genus in its reticulate ground sculpture.

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FLIGHT BEHAVIOR OF THE PREDACEOUS DIVING BEETLE, *CYBISTER FIMBRIOLATUS FIMBRIOLATUS* (SAY) (COLEOPTERA: DYTISCIDAE)

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ABSTRACT

Flight behavior of *Cybister f. fimbriolatus* (Say) is described for specimens from Florida. It is suggested that such flights are prerequisite for mating and this is an adaptive mechanism for extending the range of the species.

Many insects, as well as other animals, inhabit both an aquatic and a terrestrial environment during their life cycles. Frequently, insect metamorphosis is directly associated with emergence from an aquatic to a terrestrial environment. Members of the beetle family Dytiscidae, commonly called predaceous diving beetles, incur a similar kind of environmental change during their life cycle. The larvae, commonly known as watertigers, are restricted to the aquatic medium, however, at some advanced point they leave the water to pupate in moist earth at the water's edge. Following metamorphosis, the emerging adults, like the larvae, again inhabit the water. However, the adults of many species, unlike their larvae, also frequent the terrestrial environment as well and are capable of both graceful swimming in water and sustained flying in air. In fact, it is not uncommon to find Dytiscidae in flight some distance from water bodies.

Dytiscid flight and dispersion capabilities over short distances have been well documented by several authors, most notably Wilson (1923). However, the factors which initiate flight remain to be fully ascertained. The notion that flight occurs due to scarcity of food recurs in the literature for Dytiscidate as it does for many other insects. Contrary to this belief, my observations from both laboratory and field work indicate that the flight behavior of *Cybister fimbriolatus fimbriolatus* (Say), one of the larger species, is directly associated with mating and may be a necessary prerequisite, as well as an adaptive advantage.

During the past 3 years our laboratory has embarked on an intensive program of study investigating the feeding behavior (Johnson and Jakinovich 1970) and receptor characteristics of the sense organs borne by *C. f. fimbriolatus* (Yasazumi, Yamaguchi, and Johnson 1971). For these purposes large quantities of these beetles have been collected in the field and maintained in laboratories at the University of Michigan. The principal geographic source for these beetles has been the counties of Marion and Citrus in Florida. This semitropical region is rich in clear water springs, shallow fresh water ponds, unique river systems, and abundant cypress swamps.

Beetles were collected by various means. Some were obtained by sweeping ponds and swamps with a hand scoop net; others by using floating minnow traps left overnight with beef liver or pieces of raw fish (bluegill) as bait. In addition to these methods, many were collected at night near the street lights in Dunnellon, Florida some distance from any natural water body. During night flight, these beetles exhibit the common insect behavioral characteristic of congregating at lights. In fact, about 1 to 3 times a year congregation at lights is of such proportions in and near Dunnellon that many residents consider this beetle to be a nuisance. Collection at lights has been by far the most fruitful method of obtaining beetles, but also the most restrictive. The opportunities to collect them by this means are few.

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Swarming at lights occurs only a few times a year, usually during late spring or early summer. This is the same period which many authors report as the mating period for Dytiscidae. During the spring of the years 1969-70, each catch of beetles collected at lights and transferred to laboratory aquaria had a very high frequency of copulatory activity which gradually decreased in intensity over a period of about 3 weeks unti it ceased entirely. In fact, this high frequency of copulation was maintained in spite of unusual stress to the beetles; packing them in boxes, shipment by air from Florida to Michigan, and then transfer to aquaria. Even in these instances, beetles typically began to copulate within an hour after transfer. Copulation in laboratory aquaria has never been observed for beetles collected with nets or traps from the same area. In fact, beetles have been collected from waters within a week or 2 preceding observed flight and swarming, but these were never observed to mate. Thus, although the exact sequence of events between flight and subsequent mating remain yet to be determined, it seems definite that the 2 activities are in some way linked and that flight may be a necessary part of the life cycle of *C. f. fimbriolatus* and possibly a direct prerequisite for mating. In fact, it seems quite probable that such flight and associated mating behavior is an adaptive mechanism for expanding existing habitat (i.e. a dispersive mechanism).

Several dytiscid species, as well as other aquatic beetles, are quite common to this region of Florida, but other species have not been observed to fly in such numbers at the same times as *C. f. fimbriolatus*. Thus, it appears that species specific genetic factors, and probably environmental conditions as well, are involved in the initiation of flight and subsequent mating. Environmental variables have not been monitored in the region, but the few nights of the year that flights occur does indicate that such factors as photoperiod, temperature, and barometric pressure may play some role.

ACKNOWLEDGEMENTS

The comments of Dr. F. Young of Indiana University are much appreciated. This study was supported by NIH Grant NB 04687 to John Bardach of the University of Hawaii and NSF GU 2612.

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THE OCCURRENCE OF *BOROS UNICOLOR* SAY IN OHIO (COLEOPTERA: SALPINGIDAE)

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ABSTRACT

Overwintering adults of *Boros unicolor* Say were collected in Scioto County, Ohio in March and April, 1968 and March, 1969 under bark of dead pitch pine, *Pinus rigida*. Associates were *Alobates barbata* (Knoch) and *Idiobates castaneus* (Knoch). This is the first published record of *B. unicolor* in Ohio, and it is illustrated for the first time.

During March and April, 1968, 13 specimens of *Boros unicolor* Say were collected on 2 occasions in Scioto County, Ohio, Shawnee State Forest. This species was not found in published lists of Ohio beetles (listed in Triplehorn,

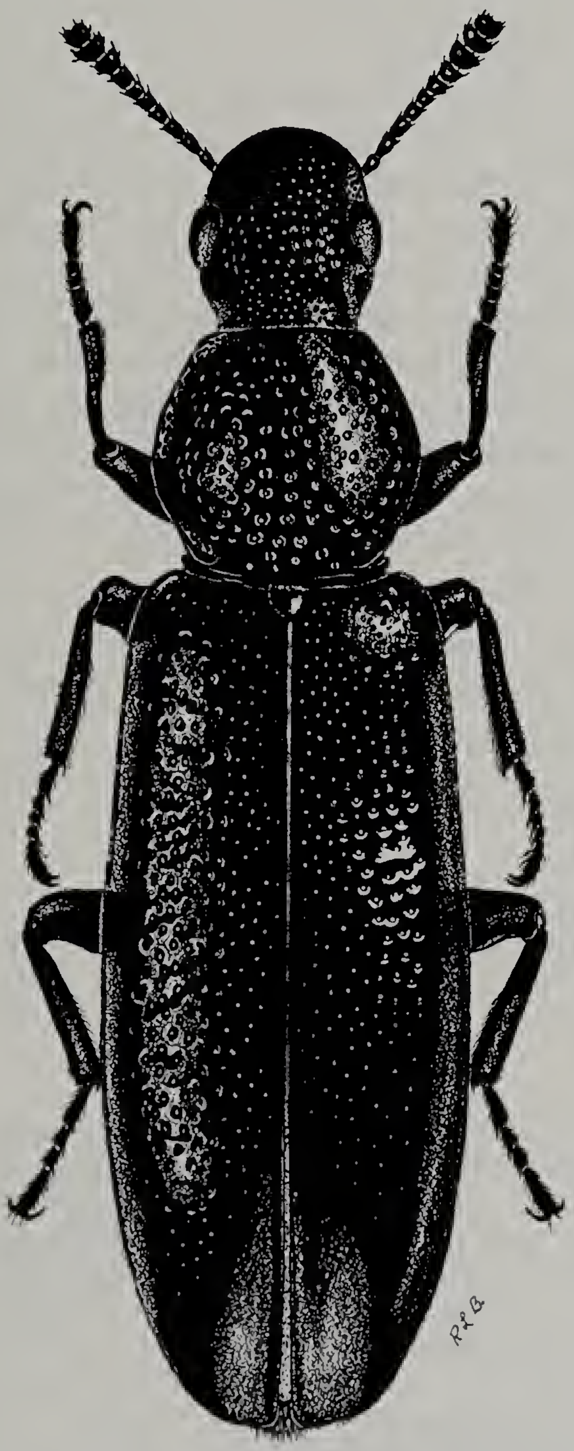

Fig. 1: *Boros unicolor* Say (actual length 12.5mm).

1952). Triplehorn (1952) included it as possibly occurring in Ohio, but stated that there were no records for Ohio. According to T. J. Spilman, U. S. National Museum, there is a specimen in the Cornell University Collection with the following data: "Salineville, Columbiana Co., Ohio, Dec. 28, 1889" (personal communication).

Because of the rarity of Ohio specimens, and because they were not found on other occasions in the same area during July and August, 1968, another search was made in March, 1969; 3 specimens were found. They were collected at 1 to 2 feet above ground level under loose bark of large, seasoned, dead pitch pine, *Pinus rigida.* Termite runs of soil and other accumulated debris provided ample protected space beneath the bark in spite of the presence of ice crystals observed in March, 1968. Associates were the tenebrionids *Idiobates castaneus* (Knoch) and *Alobates barbata* (Knoch). No more than 1 or 2 *B. unicolor* were found on a tree.

The larva of *B. unicolor* was described by St. George (1931), who reared specimens to adults and indicated that they overwinter in the adult stage. Collection dates for the Ohio specimens conform to this finding. Scioto County is near the southernmost tip of an unglaciated plateau which extends from there in a northeasterly direction to Columbiana County, proximal to the meeting of the Pennsylvania, Ohio, and West Virginia State borders. This area, occupying about one third of the State, is abruptly hilly as compared to the remaining two thirds of the State, which consists of glaciated plains and plateaus. Its apparent rarity in Ohio is believed to have resulted from a series of circumstances: adults probably die off as the "collecting season" begins; larvae, present during the "collecting season" are ignored; natural stands of pine trees are sparsely scattered throughout the unglaciated southeastern portion of Ohio and so collecting on pines, with which *B. unicolor* is usually associated, is usually not planned or thorough.

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ECOLOGICAL NOTES ON *BRADYCELLUS ATRIMEDEUS* SAY (COLEOPTERA: CARABIDAE)

ANDRÉ LAROCHELLE

C.P. 1000, Bourget College, Rigaud, Quebec, Canada

In southern Quebec, *Bradycellus atrimedeus* Say is found at the edges of standing or slow-running waters, in open or moderately shaded areas where the soil is clay-like or sandy-clayish (more or less mixed with organic matters), and where the vegetation is scarce. Other associated carabids are: *Anisodactylus discoideus* Dejean, *Bembidion frontale* Leconte, *Bembidion graciliforme* Hayward, *Bembidion patruele* Dejean, and *Elaphrus californicus* Mannerheim. Lindroth (1968, Ground-beetles of Canada and Alaska, 5:649-944) recorded the ecology of *Bradycellus atrimedeus* Say from a single specimen taken at Walsingham, Ontario, ". . . on the sandy-clayish bank of a brook" (p. 899).

A NEW *EDROTES* FROM BAJA CALIFORNIA (COLEOPTERA:TENEBRIONIDAE)

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Abstract

Edrotes fossor n.sp. is described from Mexico (Baja California, Sur) and it is distinguished from the 4 previously known species.

Four species of *Edrotes* were recognized by Doyen (1968:218) who reviewed the phylogenetic position of the genus, presented a key to species, and described *E. leechi* from Utah. The description below follows the format used by Doyen in his description of *leechi*.

Edrotes fossor Triplehorn, NEW SPECIES

General form globose, strongly convex, light to dark reddish-brown; entire dorsum sparsely clothed with long, erect, bright golden setae; entire body densely clothed with shorter, recumbent setae.

Head (Fig. 1): amplected into prothorax up to eyes; dorsally densely clothed with medially-directed golden setae, most of which are recumbent and so densely matted as to obscure surface sculpture, a few erect setae more numerous laterally; coarsely punctate ventrally, each puncture bearing a long or short golden seta; epistoma distinctly bifid apically, narrowed behind apex, strongly tumescent basally; immediate anterior margin narrowly concave within. Supra-antennal ridge obtusely angulate, coarsely punctate; labrum (frequently retracted) bilobed and clothed with golden setae which are directed cephalad and very dense anteriorly; mandibles bifid apically, each with a prominent dorsal cusp, strongly clasping labrum, cusps subequal in size; eyes nearly round; pregular cavity subequal in

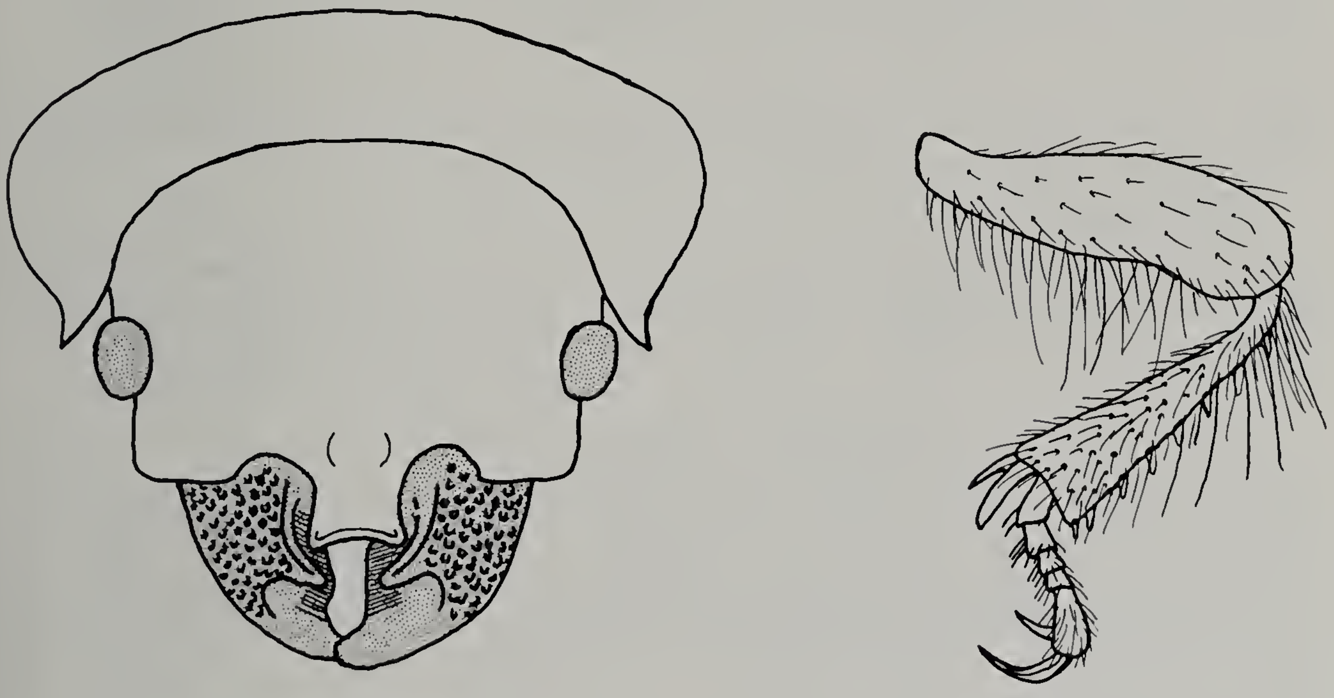

Fig. 1-2: *Edrotes fossor*. 1) Dorsal view of head and pronotum, pubescence omitted. 2) Dorsal view of left prothoracic leg.

width to mentum; antennae slender, third segment longest, subequal in length to segments 4 and 5 combined, apical 5 segments slightly expanded apically, forming a very loose club and clothed with very fine recumbent setae, terminal segment tapering to a point; mentum deeply emerginate anteriorly, coarsely and rugosely punctate; terminal segment of maxillary palpus feebly securiform, rounded apically.

Prothorax: short, transverse, convex, lateral margins rounded with little or no trace of a line or ridge delimiting upper and lower surfaces, anterior margin feebly concave, basal margin nearly straight, anterior angles acute and everted but not projecting much beyond posterior margin of eye; setae similar to those of head, directed medially and densely matted, obscuring surface sculpture, a few semi-erect setae also directed medially; ventral surface coarsely punctate, each puncture bearing a long or short, posteriorly directed golden setae; prosternal process narrower than width of procoxal cavity, strongly declivous behind coxae.

Elytra: slightly broader than long; setae sparser than on head and pronotum, longer ones semi-erect and arising from a shallow puncture cephalad of which is a small tubercle, with shorter setae directed caudad and not associated with either punctures or tubercles; long setae most abundant laterally where they form a dense fringe; epipleural ridge arcuate, obsolete opposite anterior margin of metacoxa; epipleura with only a few widely spaced, coarse punctures, each of which bears a very fine, short golden seta; scutellum obsolete.

Mesosternum, *metasternum*, and *abdominal sterna*: coarsely and densely punctate, each puncture with a short, posteriorly-directed golden seta; mesosternum feebly declivous anteriorly, barely meeting prosternal process; mesocoxae separated by less than width of mesocoxa; abdominal intercoxal process obtusely angulate; abdominal sterna 2, 3, and 4 narrow, transverse, terminal segment large, broadly rounded.

Legs: moderately long, femora clavate, barely extending beyond lateral body margins, sparsely fringed ventrally with long golden setae; protibia (Figure 2) strongly expanded apically, outer angle produced and prominent, ventral surface somewhat concave; mesotibia and metatibia moderately expanded apically; all tibiae sparsely clothed both dorsally and ventrally with long, golden setae and with outer edges serrate, each serration bearing a blunt, curved spine; apical tibial spurs short and stout.

Sexes externally identical.

Mean length (elytra and prothorax) of 67 specimens: 5.65mm; standard deviation: 0.29mm; range: 4.9 to 6.4mm. Mean width (elytra at broadest point): 4.78mm; standard deviation: 0.29mm; range: 4.0 to 5.4mm.

Holotype (sex undetermined): MEXICO, Baja California, Sur, 1 mile east of Casas Viejas, Sierra de la Victoria Mts. (800 feet), 27-X-68, E. L. Sleeper and F. J. Moore (Ohio State University Collection of Insects and Spiders). *Paratypes*: 42 with same data as holotype; 24 from Baja California, Sur, 2.5 miles south of Santa Anita (400 feet), 2-XII-68, E. L. Sleeper and F. J. Moore. Paratypes deposited in collections of The Ohio State University, Long Beach State College, United States National Museum, and California Academy of Sciences.

Edrotes fossor resembles *leechi* Doyen more closely than any other member of the genus, and Doyen's photographs of *leechi* could almost suffice for *fossor*; both species have strongly declivous mesosterna and narrow prosternal processes which barely meet; while in *ventricosus* LeConte and *arens* La Rivers the prosternal process meets the mesosternum firmly and broadly in about the same plane; *rotundus* (Say) is somewhat intermediate in regard to this character. *E. fossor* will run to *ventricosus* rather than *leechi* in Doyen's key because it lacks the unique spatulate process on the basal protarsal segment of *leechi.*

The mandibular cusps of *fossor* are not unique, since all species of *Edrotes* have at least a slight modification of the mandibular base. These cusps are very prominent in some specimens of *ventricosus*, but they are not as strongly convergent as in *fossor*, and in most instances the right cusp is better developed than the left.

The most diagnostic characters for separating *fossor* from the other 4 species of *Edrotes* are the expanded protibiae, the shape of the epistoma and the prominent tumescence at its base, and the very thick dorsal vestiture of the head and thorax.

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* * *

LITERATURE NOTICE

CATALOGUE OF TENEBRIONID TYPES

In 2 previous issues (Coleopt. Bull. 25(2 & 3)) we have noted several catalogues and lists of type material in various collections. The following paper was brought to our attention by T. J. Spilman:

Kulzer, H. 1963. Verzeichnis des Typenmaterials der Tenebrionidensammlung des Museums G. Frey. Ent. Arbeit. Mus. G. Frey 14(2): 375-434.

This fantastically long list of species is indicative of the extensive beetle collection of the Frey Museum. In 1959, the collection contained approximately 12,000 species of Tenebrionidae (72% of the known species), including 1700 types and 2000 paratypes. The list is alphabetically arranged by genus and species. Also noted are the describers, date of publication, and whether holotype or paratype. The introduction contains data on the private collections encompassed and the taxonomists who worked on this material.—R. E. Woodruff.

LITERATURE NOTICE

In 1948, Jean Balazuc published his extensive work on beetle monstrosities: "La Tératologie des Coléoptères et experiences de transplantation sur *Tenebrio molitor* L.", Mém. Mus. Nat. Hist. Nat. (Paris) (New Series) 25:1-293; 223 fig. He recorded and illustrated the many freaks, and provided an extensive bibliography on the subject. He also attempted explanations for such anomalies.

In 1969, he brought this work up to date with: "Supplément à la Tératologie des Coleopteres." Redia 51:39-111; 17 fig.—T. J. Spilman.

COLLECTING HIBERNATING GROUND BEETLES IN STUMPS (COLEOPTERA: CARABIDAE)

André Larochelle
C. P. 1000, College Bourget, Rigaud, Quebec, Canada

Abstract

Five hundred eighty ground beetles, representing 19 species, were collected from tree stumps in November at St. Redempteur, Quebec.

A large majority of the species of Carabidae apparently hibernate as adults. On the cold afternoon of November 16, 1969, I collected many ground beetles in rotten tree stumps of a woodland swamp at Saint-Redempteur, Vaudreuil County, Quebec. In a few hours, I captured 580 motionless specimens of 19 species. A few species appeared to be gregarious in hibernation: *Agonum decentis* Say, *A. gratiosum* Mannerheim, and *A. puncticeps* Csy. Some species seem to favor superficial cover; the following were taken under bark of stumps: *A. gratiosum* Mannh., *A. puncticeps* Csy., *Bembidion muscicola* Hayward, *Lebia atriventris* Say, and *L. fuscata* Dejean.

The total list follows, with the numbers of each species in parentheses: *Agonum decentis* Say (88), *A. gratiosum* Mannerheim (335), *A. melanarium* Dejean (2), *A. placidum* Say (2), *A. puncticeps* Csy. (49), *A. retractum* LeConte (14), *A. sordens* Kirby (1), *Bembidion muscicola* Hayward (3), *Calathus gregarius* Say (1), *Lebia atriventris* Say (1), *L. fuscata* Dejean (1), *Loricera pilicornis* Fab. (3), *Olisthopus parmatus* Say (1), *Pterostichus coracinus* Newman (1), *P. luctuosus* Dejean (55), *P. lucublandus* Say(1), *P. patruelis* Dejean (5) *P. pensylvanicus* LeConte (16), *Sphaeroderus lecontei* Dejean (1).

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WING-DIMORPHISM IN *CALATHUS INGRATUS* DEJEAN (COLEOPTERA: CARABIDAE)

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The hind-wings of this species are normally very reduced but 3 fully-winged specimens were seen from Alaska by Lindroth (1966, Ground-beetles of Canada and Alaska, 4:409-648). I have examined 481 specimens of this species from Quebec and found 12 fully-winged specimens from the following localities: Gaspé-Ouest Co., Rivière-la-Madeleine, 25-VII-70 (1 female); Iles de la Madeleine Co., Ile du Havre Aubert, 3-VIII-70 (1 female); Mistassini Territory, Fort Rupert, 18-VII-68 (1 female, 1 male); Nouveau-Quebec Territory, Poste-de-la-Baleine, 24-VII-68 (1 female) and Schefferville, 21-VII-71 (3 females, 2 males); Saguenay Co., Moisie, 19-VI-71 (1 female) and Sept-Iles, 19-VII-71 (1 female). In Quebec, the long-winged forms of *Calathus ingratus* Dejean are rare and not geographically restricted. They occur in the same populations as short-winged forms, in both sexes, and they are undoubtedly functional.
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A NEW STATE RECORD FOR *POLYPHYLLA* AND ITS ZOOGEOGRAPHIC IMPLICATIONS (SCARABAEIDAE: MELOLONTHINAE)

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Abstract

Polyphylla Harris is first recorded from Wisconsin, represented by *P. hammondi* LeConte. The deme sampled is geographically disjunct from the continuous species range and is recorded from an environmental refugium in an area commonly called the Wisconsin Desert. On the bases of this new record and 4 other relict *hammondi* demes, it is proposed that this species 1) invaded as far east as Wisconsin via the Pliocene Steppe, 2) retreated during the Pleistocene, 3) secondarily invaded eastwards via the postglacial xerothermic prairie peninsula and, 4) secondarily retreated westwards in response to destruction of the xerothermic prairie leaving western relict demes in unique eastern environmental refugia.

Introduction

Through the courtesy of K. I. Lange, Park Naturalist, Devil's Lake State Park, Wisconsin, I was recently able to determine an avittate male *Polyphylla hammondi* LeConte, collected in Wisconsin. The data associated with this specimen, which constitutes the first record of the genus in Wisconsin, are as follows: Wisconsin: SW Sauk County, ca. 1 mi. N. Spring Green, 9-VII-71, K. I. Lange and F. J. Rich, captured at dusk emerging from burrow.

Lange (personal communication) also collected several other specimens on the evening of July 9 as they flew into the light of a Coleman lantern. This area, sometimes termed the Wisconsin desert, is within the flood plain of the Wisconsin River. Sandy terraces are composed of both shifting sand blows and dunes and areas of relatively stabilized sand. This unique habitat extends inland, away from the river valley until terminated by abrupt, limey bluffs. Lange also recorded 2 other insect species endemic to this area of Wisconsin: the cicada, *Diceroprocta vitripennis* (det. T. E. Moore), and the cicindelid beetle, *Megacephala virginica* (det. J. Lawton).

The distribution of *P. hammondi* in America north of Mexico, based on 1,451 specimens, shows a pattern (Fig. 1) of relatively continuous occurrence throughout the central and southwestern states. Four geographically disjunct demes are recorded, however: 1) Anoka Co., Minnesota (Fridley Sand Dunes), 2) Mason Co. (Havannah) and 3) Union Co. (Reynoldsville), Illinois, and 4) Posey Co., Indiana. The new state record presented here represents the fifth known disjunct deme for the species *hammondi.* In all cases, there is an exact correlation between the existence of these geographically isolated demes, and the unique presence of well-drained sandy soils or actual sand dune areas.

DISCUSSION

When conspecific populations are geographically disjunct it is assumed that either (a) the species is actively colonizing new areas or (b) the species once had a broader range encompassing the sites of the now disjunct demes. As all the disjunct *hammondi* demes are found in similar sandy refugia uniquely suited to their survival, it seems most probable that they do represent geographical relicts rather than new colonies. The probability of such colonies being established in several widely separated but ecologically similar areas is surely very low. The following historical sequence is proposed to explain the existence of these disjunct demes: 1) Original invasion as far east as Wisconsin via the dry Pliocene Steppe. 2) Retreat westwards and southwards in response to the environmental rigors of the Pleistocene. 3) Secondary invasion as far east as Wisconsin via the postglacial xerothermic prairie peninsula. 4) Secondary retreat westwards in response to destruction of the xerothermic prairie, with western relicts left in eastern environmental refugia.

Late Pliocene uplift of the Sierra Nevada-Cascade and Peninsular ranges of southern California furnished a new barrier for incoming moisture. The rain shadow effect produced by this orogeny, along with a general uplift

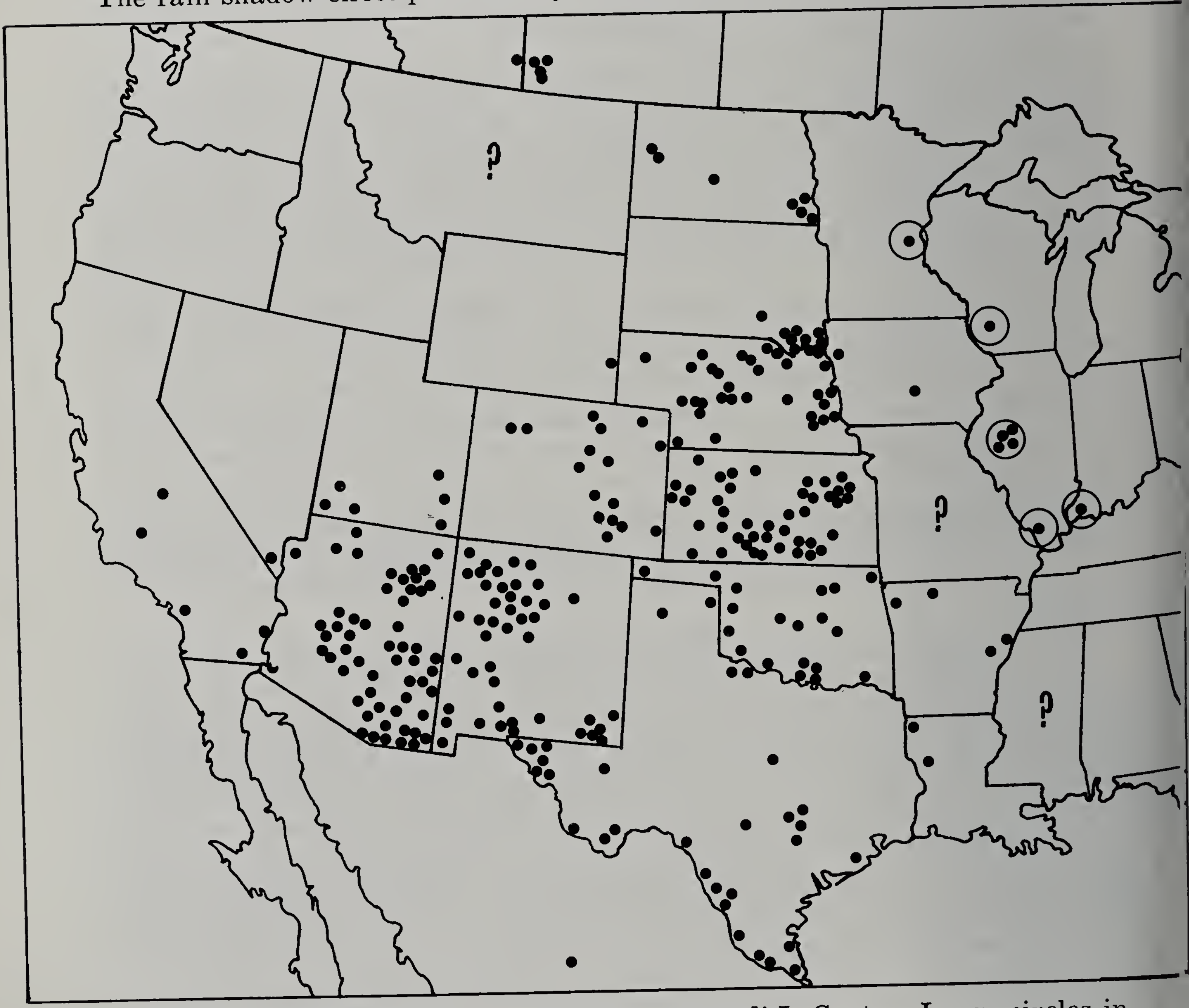

Fig. 1. Distribution of *Polyphylla hammondi* LeConte. Large circles indicate disjunct demes; question marks indicate state record with no additional data.

of the interior plains caused the drier environment which in turn caused the major decline of forests and eastwards expansion of the grasslands recorded in the Pliocene (Dodson, 1960). This middle Pliocene grassland steppe is offered as the most likely pathway by which elements of *hammondi,* and probably *Polyphylla* as a whole, first spread to the east, as outlined in step number 1 above.

It is quite well demonstrated in the literature (Howden 1963, 1966, and 1969) that many scarab groups were well established in midwestern and eastern North America before the Pleistocene. Some of the species we see today must have been isolated by then, with further fragmentation most likely caused by the rigors of the Pleistocene. It is proposed here that *hammondi* may be offered as a case in point, having been directly subjected to the Pleistocene environment of glaciers (Flint, 1957), pluvial conditions, and periglacial climates. Pleistocene glaciers physically covered the Minnesota and Illinois localities now hosting *hammondi,* while the Indiana and Wisconsin sites were ice free but subject to severe periglacial climates (Flint, 1957). These environmental factors are the most probable causative agents explaining the considerable westwards retreat of the range of *hammondi* outlined in step 2 above.

If all or any of the more eastern demes were forced westward and southward during the Pleistocene, postglacial reinvasion of the east had to take place. Postglacial climatic and vegetational chronologies offer the environmental matrix for this to have been possible. With the retreat of the ice, pollen records show the concurrent retreat of a belt of tundra parallel to the ice front (Smith, 1957). Other records of spruce-fir (cool wet), oak-hemlock (warm wet), and oak-hickory (warm dry) zones, indicate a cool-warm postglacial climatic sequence (Deevey, 1949). This postglacial warming trend, which peaked during the Xerothermic, caused a decline in mesic forests and their replacement by a drier oak-hickory grasslands complex (Elias, 1942). This phase, now well known as the prairie peninsula, allowed *hammondi* to reinvade the east, as proposed in step 3 above.

During the final climatic stabilization at the close of the Xerothermic, cooler moister conditions returned to much of eastern North America (creating a cool-warm-cool postglacial sequence), accompanied by an encroachment of mesic forest onto the more xeric steppe or grasslands (Smith, 1957). As the great mass of the eastern steppe was destroyed, animal species living there were forced to 1) retreat to the west from where many of them originally came, 2) adapt, or 3) be subject to extinction. As Figure 1 shows, the majority of *hammondi* demes were unable to survive, except for those relicts we see today in Minnesota, Illinois, Indiana, and Wisconsin. This reinvasion of the mesic forest is offered as the primary causative agent for step 4 above, with relict *hammondi* demes surviving only where the drier prairie peninsula habitat survived.

This phenomenon of western relicts displaced east of the species main range via these post-glacial environmental fluctuations is repeated in many species of animals, especially amphibians and reptiles (Smith, 1957; Schmidt, 1958). The pattern shown by *hammondi* is in fact, nearly the same as that shown by the hog-nosed snake, *Heterodon nasicus,* with a relict deme found in the identical sandy refugium at Havana, Illinois (Smith, 1957).

ACKNOWLEDGEMENTS

I owe special thanks to the aforementioned K. I. Lange, who first brought to my attention the existence of *Polyphylla* in Wisconsin and has furnished field notes for this publication. For the loan of specimens from each of the other refugia areas I want to thank the AMNH (New York), FMNH (Chicago), Ill. Nat. Hist. Surv., Purdue Univ., and the USNM.

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* * *

BOOK REVIEW

The beetles of the Pacific Northwest. Part V. *Rhipiceroidea, Sternoxi, Phytophaga, Rhyncophora,* and *Lamellicornia,* by Melville H. Hatch. Jan., 1972. University of Washington Press, Seattle, Wash. 650p; 687 fig. Cloth $20.00

With the completion of this monumental series, the year 1972 is bound to be a banner year for Coleopterists, even if nothing else significant transpires. There have been extensive local or faunal studies in Europe for many years, but we have had notably few (e.g., Blatchley's "Coleoptera of Indiana", 1910) such works in this country. Dr. Hatch has devoted a lifetime of study and dedicated effort in completing this 5-volume set which started in 1953. It is certainly not necessary to enumerate the problems involved in such a pretentious task as to present a faunal treatment of the largest order in the animal kingdom and in a geographic area as large as British Columbia, Washington, Oregon, and Idaho. The 19 years between the first and last volumes undoubtedly have been filled with many hours of the "midnight oil" for Dr. Hatch and his collaborators.

At the beginning of the series Dr. Hatch estimated that 3,000 species would be involved—the kind of number which has dissuaded most workers who would contemplate such regional faunas. In the final analysis there are about 4,300 species treated in the 2,164 pages and 2,727 fig. It will probably be a long time before another lifetime is available for such an undertaking and the sacrifices necessary to see it to completion. Aside from any shortcomings noted by individual specialists, coleopterists in particular owe Dr. Hatch a "standing ovation" for such prodigious effort. The entomologists in the area covered are indeed fortunate in having such a manual as a basis for identifying their beetles, determining what is known about a given species, and from which future studies can easily proceed. The Pacific Northwest will now be the envy of the remainder of the country —and just maybe this work will stimulate similar work elsewhere.

For those who have not kept up with the series as it was issued, the following list presents the statistics for each volume:

Part I. Introduction and Adephaga. 1953. 248p., 38 pl. of 355 fig. $15.00.
Part II. Staphyliniformia, 1957. 395p., 37 pl. of 549 fig. $15.00.
Part III. Pselaphidae and Diversicornia 1. 1962. 503p., 66 pl. of 818 fig. $20.00.
Part IV. Mocrodactyles, Palpicornes, and Heteromera. 1965. 268p., 28 pl. of 318 fig. $12.50.
Part V. Rhipiceroidea, Sternoxi, Phytophaga, Rhyncophora, and Lamellicornia. 1972. 650p., 55 pl. of 687 fig. $20.00.

The entire set of 5 bound volumes is available from the publisher at $82.50. Some of the volumes were originally advertised at a lower price (e.g., Part I, unbound, $5.00; Part II, bound, $7.00). However, I suspect that the University of Washington Press, like most of its counterparts at other universities, will still "lose money" in the over-all production. This makes it even more commendable that the Press should provide this valuable reference to the scientific community. To the worker with a small budget for literature the price might appear high, but compared with the cost of compilation and printing, it would be a bargain at double this figure.

Part V is the largest volume of the set, treating about 1,300 species of the following families: Rhipiceridae, Elateridae, Eucnemidae, Throscidae, Buprestidae, Cerambycidae, Chrysomelidae, Bruchidae, Anthribidae, Curculionidae, Platypodidae, Scolytidae, Lucanidae, and Scarabaeidae. The following specialists are listed as collaborators for this volume: M. C. Lane, H. P. Lanchester, W. F. Barr, S. M. Hogue, L. G. Gentner, B. D. Valentine, S. L. Wood. The Preface was written in May, 1971, and contains information on articles affecting the body of the text, but which were noted too late for inclusion. The Appendix is an extremely useful 16-page list of abbreviations of names of authors of genera and species, with their full names, dates of birth and death (or where unknown, dates of publishing), city or county where they lived, and references to their occupation or professions. The 28-page Bibliography is somewhat different from most— articles cited only once or twice are listed only in the text, and others are abbreviated there and cited completely in the terminal bibliography. There is a complete index to generic, subgeneric, and specific names.

Naturally such as extensive treatise is out of date when published and, as Dr. Hatch states, ". . . is likely to contain mistakes of identification and other errors of both commission and omission." Some such errors have been listed in reviews of the first 4 parts, and a list of errata for Parts III & IV is provided in Part V.

Although I don't feel qualified to review critically the contents of all Parts, I have made the following notes on Part V, although no thorough review is attempted:

p. 6—The family Throscidae is listed in the Key, although the Table of Contents and the text on page 53 list Trixagidae.

p. 433—"*Sinodendrox*" should be *Sinodendron.*

p. 462—"*violacepus*" should be *violaceous.*

p. 434—couplet 3' of the key lists ". . . scutellum covered by base of pronotum" as a character of Scarabaeinae, but, of the 3 genera covered, *Oniticellus* (p. 460) has a visible scutellum.

p. 453 & 455—"*Aphodius leopardus*" is treated under 2 different subgenera, with slightly differing accounts.

p. 462—The describer of *Onthophagus hecate* should be Panzer, not Payk.

p. 465—The author of *Serica* should be W. S. MacLeay, not W. J. MaCl.

p. 463-64—Species of the genus *Trox* are listed in the Key and text without reference to male genitalia which are the most diagnostic features.

p. 484—The old name *Trichinus* Kirby 1837 is revived to replace *Trichiotinus* Casey, used by most American authors.

p. 458—*Ataenius* is described as "rufous" although most species are nearly black.

p. 616—Fig. 3 & 6 are labelled "*Lechriops californica*", although Fig. 6 is obviously a Ceutorhynchine and unlike Fig. 3. Plate XLI, Fig. 3 is also an example of the poor reproduction when a drawing was copied from another publication; Fig. 4 on the same plate is an exceptionally fine reproduction.

The 2,727 figures add immensely to the usefulness of the books, and many are originals, although full use was made of existing illustrations from many sources. The habitus drawings of Mrs. Helen Houk are worthy of special note because of their technical accuracy, as well as esthetic appeal. Too seldom are even smaller papers illustrated as well or as extensively as this enormous work.

As an editor, I have several points of style which I find objectionable, but they are perhaps personal preferences and do not seriously affect the book's usefulness. The descriptions are incorporated in the Keys, and the couplets, although dichotomous, are not side by side for easy comparison. Scientific names, in both text and bibliography, are not italicized except for synonyms. Journal is abbreviated "Jr." although this abbreviation is normally reserved for "junior."

The arrival of such a monumental work should provide a great stimulus for future work in the Pacific Northwest. Coleopterists in that area can fulfill part of their obligation to Dr. Hatch by continuing to enlarge and improve upon his efforts.—R. E. Woodruff.

(*continued from inside front cover*)

or counties listed. Dates are listed by day, month (in Roman numerals), and last 2 digits of the year. Listing of ecological data is encouraged. Location of specimens should be shown in brackets; if the data is extensive these should be abbreviated as shown and the abbreviations listed in the text.

Any article concerning Coleoptera will be considered. Descriptions of new taxa must contain keys (or be correlated with existing keys) and illustrations. All manuscripts should be typed on 8½x11" opaque white paper with 1 inch margins. They should be typed on one side only and double spaced throughout (including title, footnotes, tables, figure legends, and references). All scientific names should be underlined. Use the following order: title, author, author's address, abstract, body of text, references cited, and figures. All footnotes, tables, and figure legends should be provided on separate sheets and double spaced. Indicate approximate figure and table locations in pencil in the margin of the manuscript.

An abstract should be a concise statement of the facts presented, not *that* they are presented (e.g. list names of organisms, not just that they were discussed or described as new). These abstracts are the key to how your article will be cited in the abstracting journals and should be carefully written.

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NOTICES

Notices to appear on this page are a free service to members and subscribers. Such copy will be limited to the back page, the older notices being moved up and replaced with the newest ones at the bottom. The editor reserves the right to reword such notices for brevity, consistency, and clarity.

BEETLE MITES: I am engaged in research on Poromegistidae which are phoretic on insects. They are known from Carabidae (**Scarites** & **Harpalus**), Scarabaeidae, Passalidae (in Australia), millipedes, and ants. Will exchange or purchase these mites in alcohol. W. J. Voss, Texas Tech. College, Dept. of Biology, Lubbock, TX 79409.

SHARP & MUIR: THE COMPARATIVE ANATOMY OF THE MALE GENITAL TUBE IN COLEOPTERA. The classic 1912 monograph and 6 other papers by the same authors, 304 p., 43 pl., bound; $10.00. An essential book for all coleopterists. Entomological Society of America, 4603 Calvert Rd., College Park, MD 20740.

CICINDELIDAE: The following 3 papers are in preparation: "Cicindelidae of Quebec," "Food of cicindelids of the world," and "**Cicindela ancocisconensis** Harris." Label data, observations, and food habit notes would be appreciated. Andre Larochelle, College Bourget, C. P. 430, Rigaud, Quebec, Canada.

SCARABAEIDAE: Studying myrmecophilous and termitophilous Aphodiinae. Request loan of New World material especially. Will sort from general scarab collections or from light trap samples. Robert E. Woodruff, Fla. Dept. Agr., P. O. Box 1269, Gainesville, FL 32601.

HYDROPHILIDAE: Presently revising the genus **Hydrochus** from North, South, and Central America, including the Antilles. Request loan of any material from the Western Hemisphere. John L. Hellman, Ent. Dept., Univ. Maryland, College Park, MD 20742.

TENEBRIONIDAE: Building world-wide reference collection. Will purchase or exchange other Coleoptera. Especially desire immature stages. Kirby W. Brown, Peabody Museum, Yale Univ., New Haven, CT 06520.

HELODIDAE: Revising **Elodes**, need material from NW, W, SW, & S. Will pay postage. Prefer wet material, but mounted or dry OK. Desire larvae also. G. G. Kennen, 381 N. Central Ave., Ramsey, N.J. 07446.

CERAMBYCIDAE: Longicornes du Laos by Gressitt, Rondon, and Breuning. Pacific Insects Monograph 24, 1970, 651 p., 102 pl. (2 color), maps. Over 1000 species illustrated. $17.50 hard cover; $16.00 paper. Bishop Museum Press, Box 6037, Honolulu, HI 96818.

WORLD RESEARCH DIRECTORY: Richard L. Jacques and Dr. Ross H. Arnett, Jr. are preparing a world list of **current** research projects on Coleoptera. A volume will be published as a companion to the recently published "Directory of Coleoptera Collections." Anyone wishing to have a research project listed should write to R. L. Jacques, Dept. of Entomology, Purdue University, Lafayette, Indiana 47907. Forms will be provided.

CLEROIDEA: Conducting world-wide research on internal anatomy. Will exchange North and Central American groups for liquid (10% Formalin, etc.) preserved Cleroidea. Building world reference collection of Cleridae; will purchase or exchange. Ginter Ekis, Dept. Ent. & Econ. Zool., Rutgers, Univ., New Brunswick, N.J. 08903.

SCARABAEIDAE: Wanted, various species of **Megasoma**, male and female, major and minor forms. Will exchange pairs of **M. pachecoi**. Terry W. Taylor, 8529 Norwood Place, Rosemead, CA 91770.

OEDEMERIDAE: Specimens needed for World Revision now under way. Need especially material from Africa, Asia, and South America. Ross H. Arnett, Jr., care of Florida State Collection of Arthropods, P. O. Box 1269, Gainesville, FL 32601.

CICINDELIDAE: Interested in obtaining specimens of **Cicindela hirticollis ponderosa** Thoms. from area of Veracruz, Mexico. Will exchange other Coleoptera. R. C. Graves, 627 Crestview, Bowling Green, Ohio 43402.

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DYTISCIDAE (Bidessines): Revising genera **Anodocheilus** and **Neobidessus** for tropical America. Will sort from general collections or light trap material, but promise only generic determinations of other Dytiscidae. F. N. Young, Dept. Zoology, Indiana University, Bloomington, Ind. 47401.

SCARABAEIDAE: Working toward a world revision of the Anomalini. Specimens and records needed from all areas, by loan, purchase, or general exchange. Identifications by arrangement, correspondence invited. R. W. L. Potts, California Acad. Sci., Golden Gate Park, San Francisco, CA 94118.

WANTED: One copy of "Catalogue of the Coleoptera of America, north of Mexico" by C. W. Leng, 1920. P. P. Shubeck, Biology Dept., Montclair State College, Upper Montclair, N. J. 07043.

COCCINELLIDAE: North American specimens and locality records of **Coccinella undecimpunctata** L. required for distribution study of this species. M. Y. Watson, Dept. Biology, Laurentian Univ., Sudbury, Ontario, Canada.

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REPRINTS DESIRED: Now working on the interpretation and integration of available evidences on phylogeny in construction of a phylogenetic classification of Coleoptera. Reprints are requested from specialists in all families. Mohammad Abdullah, Zoologische Staatsammlung, 8 Munich 19, W. Germany.

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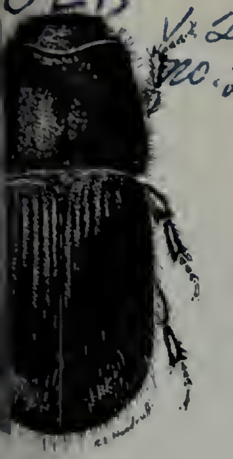

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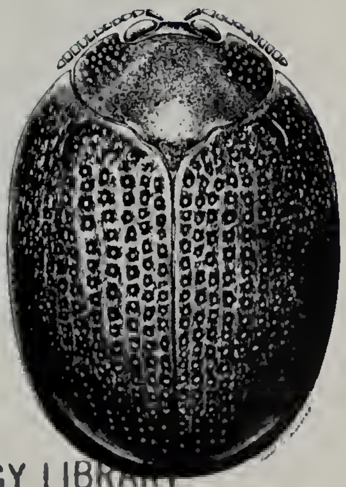

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(FOUNDED 1947 BY ROSS H. ARNETT, JR.)

The **Coleopterists Bulletin** is published quarterly, beginning in March, by the Coleopterists Society. All manuscripts, editorial questions, or business matters should be sent to the editor: Dr. Robert E. Woodruff, Florida Department of Agriculture, P.O. Box 1269, Gainesville, Florida 32601.

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The **Coleopterists Newsletter** is a mimeographed publication issued twice a year and mailed to all members of the Coleopterists Society regardless of whether they have a subscription to the **Coleopterists Bulletin.** News items and correspondence concerning the **Newsletter** should be sent to the editor: Dr. C. W. O'Brien, Div. Entomology, Texas Tech Univ., Lubbock, TX 79409.

NOTICE TO AUTHORS

Manuscripts will be considered from any authors, although those from members of the Coleopterists Society will be given priority. It is suggested that all prospective authors join the Society. All manuscripts should conform to instructions in the **Style Manual for Biological Journals** (2nd Ed.) prepared by the Committee on Form and Style of the Conference of Biological Editors, and published by the American Institute of Biological Sciences, 2000 P Street NW, Washington, D. C. 20063.

The following exceptions are noted: 1) All geographical names are to be spelled out, 2) use words, not symbols, for male and female, 3) use numerals throughout, except to begin a sentence, 4) entomology, -ical, -ist, etc. are to be abbreviated Ent. in literature citations.

Specimen label data should be listed in the following manner: MEXICO: State of Veracruz, Fortin de las Flores, 10-VIII-70, I. B. Jones, under bark of **Pinus moctezumae**, 7000ft. [USNM] (2). The number in parentheses indicates the number of specimens. Geographical names are listed in order with largest units first, with states, departments, provinces, parishes, and/

Continued inside back cover

(Mailed under second-class permit at Gainesville, Florida. Postmaster: send form 3579 to editorial office—Dr. R. E. Woodruff, P. O. Box 1269, Gainesville, FL 32601).

TWO NEW GENERA OF SOUTH AMERICAN ELMIDAE (COLEOPTERA)

H. E. HINTON
Department of Zoology, University of Bristol, England

ABSTRACT

Tyletelmis mila, a new genus and species, is described from Brazil and French Guiana. A new genus, *Tolmerelmis*, is erected to contain *Heterelmis pubipes* Hinton of Brazil and Argentina.

INTRODUCTION

On a collecting expedition to South America in 1937 I obtained a large series of a small and very distinctive elmid belonging to a new genus and species, *Tyletelmis mila*, that is widely distributed in the Amazon basin and also occurs in French Guiana. In this paper a new genus, *Tolmerelmis*, is erected for *Heterelmis pubipes* Hinton (1936). The type locality of *T. pubipes* is Brazil: Santa Catharina. I have recently seen 12 specimens of this species taken by M. J. Viana in Argentina: Misiones, Santa Maria.

Tyletelmis Hinton, NEW GENUS

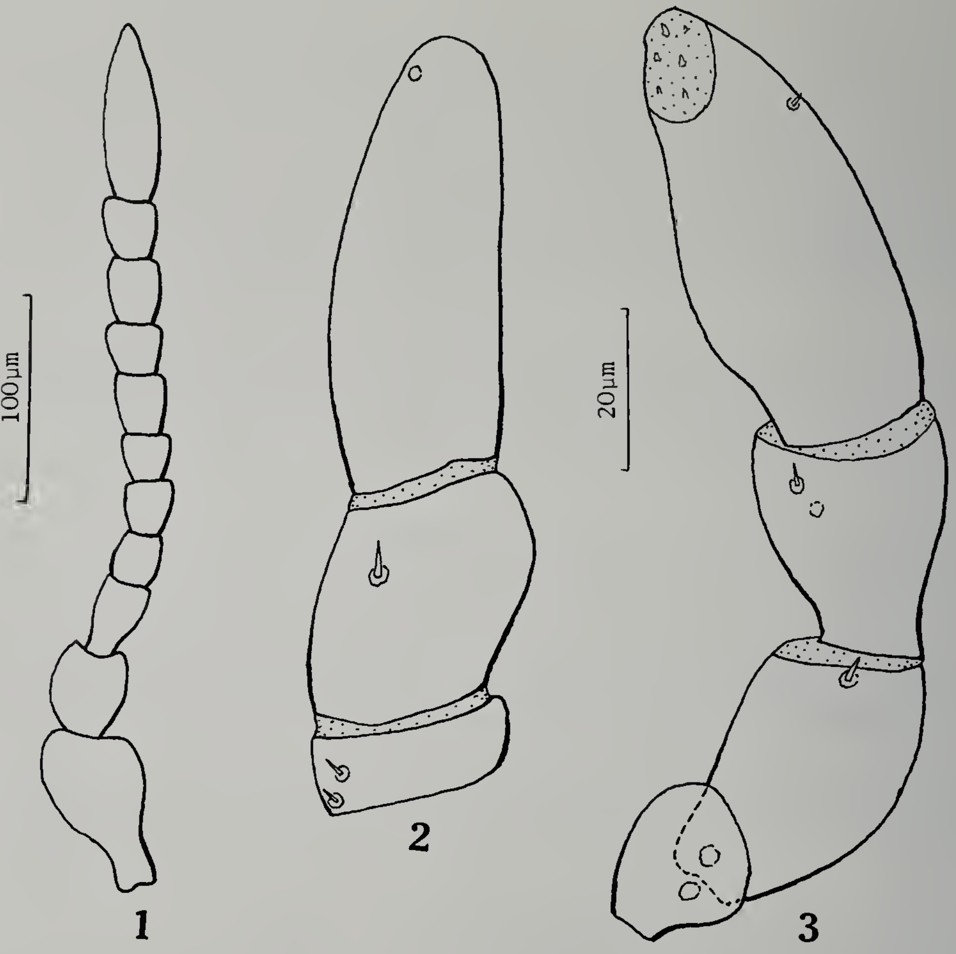
Body subparallel. Antennae (Fig. 1) 11-segmented. Maxillary palpi (Fig. 3) 4-segmented. Pronotum with a well-developed sublateral carina (Fig. 7, A) on each side extending from base to about apical sixth; disk more or less evenly convex, without depressions; lateral edge of pronotum when seen from side double. Elytron with a single, very well-developed sublateral carina that extends from humerus to about apical fifth; carina (Fig. 7, C) sharp-edged, not consisting of a row of granules. Prosternum short, with side in front of coxa scarcely longer than width of front of coxa; process between coxae broad; carinae prominent and extending nearly to anterior margin. Abdomen with distinct sublateral carinae on disk of first sternite (Fig. 7, D). Legs with a single cleaning fringe on front and hind tibiae and with 2 fringes on middle tibiae; claws slender, not toothed. Plastron of scale-like setae (Fig. 7, E) present on the following areas: head below and behind eyes; epipleura; sides of prosternum; sides of meso- and metasternum; all of sides of abdomen; and legs except for trochanters and tarsi.

GENOTYPE: *Tyletelmis mila* Hinton, new species.

COMPARATIVE NOTES: *Tyletelmis* bears a resemblance, but only a superficial one, to some species of *Limnius* and *Austrolimnius*, but it is not closely related to any other known genus.

Tyletelmis mila Hinton, NEW SPECIES
(Fig. 1–7)

Male. Length, 1.2mm; breadth, 0.6mm. Cuticle reddish brown with antennae and legs paler. Dorsal surface everywhere with fine, recumbent setae that are about as long as first antennal segment. *Head* with eyes large, major axis with 11-12 facets. Antenna (Fig. 1) relatively short, only extending to about middle of pronotum. Front between eyes with a fine, reticulate microsculpture and with shallow punctures about two-thirds



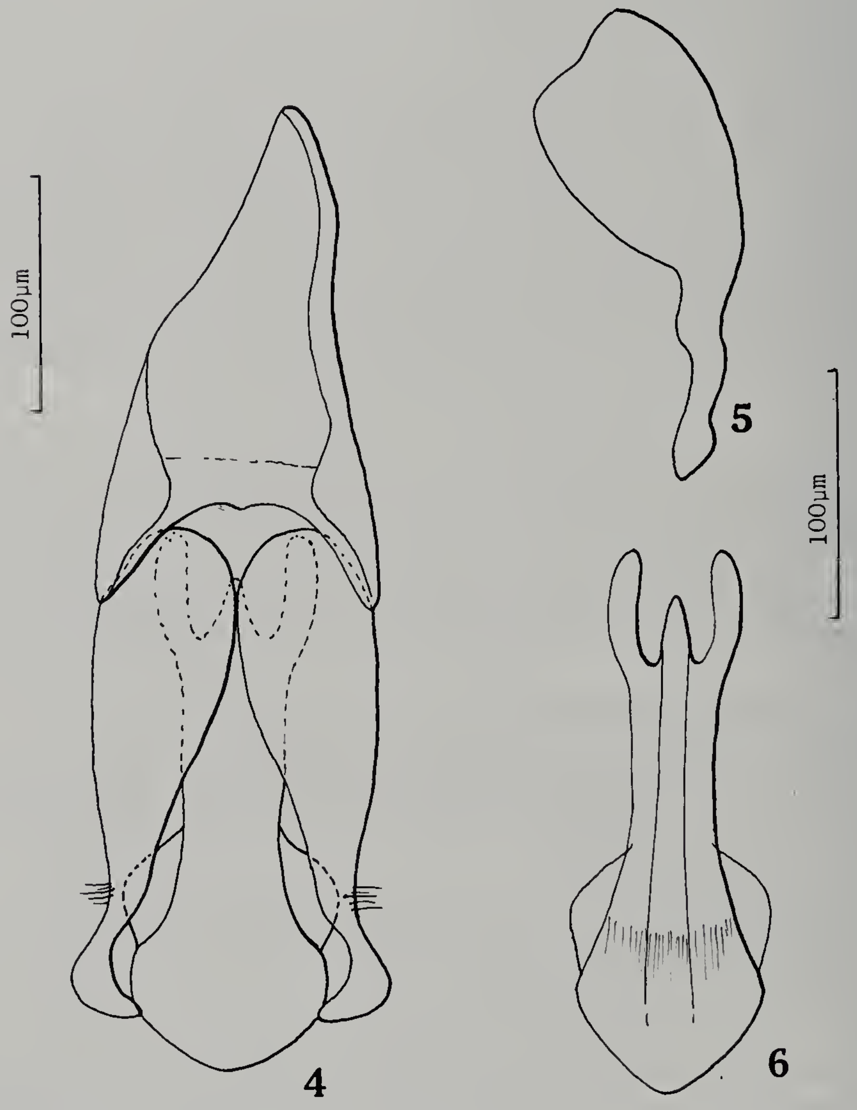


Fig. 1-3: *Tyletelmis mila*, sp. n. 1) antenna; 2) labial palp; 3) maxillary palp.

Fig. 4-6: *Tyletelmis mila*, sp. n. 4) dorsal view of male genitalia; 5) inner view of a paramere; 6) dorsal view of median lobe.

as coarse as facets of eyes and usually separated by 2 to 3 diameters. Clypeus with anterior margin shallowly and broadly, arcuately emarginate; labrum with anterior margin also arcuately emarginate but more deeply so. *Pronotum* with broadest point, which is at about middle, broader than long (0.57mm : 0.40mm) and base broader than apex (0.53mm : 0.42mm). Lateral margin with double edge; when seen from side about as thick as apex of second antennal segment except near apex where it is distinctly narrower; double edge not as distinct as in, for instance, most species of *Neoelmis*. Basal angles strongly produced behind (Fig. 7, A). Disk (Fig. 7, A, B) with surface sculptured like front of head but towards base with reticulate microsculpture much less evident or absent and punctures slightly coarser and more distinct. *Hypomera* everywhere with a reticulate microsculpture. *Elytra* with base slightly narrower than pronotum; distinctly widened behind to broadest point (at about apical two-fifths). Striae often scarcely impressed even on basal discal region; strial punctures on basal discal region shallow, round, only about a third as broad as intervals, and separated longitudinally usually by 2 to 3 diameters; in many specimens the striae are more distinctly impressed and the strial punctures slightly coarser. Intervals flat; surface with punctures often nearly as coarse as strial punctures, and, when this is so, punctures of the intervals are not easily distinguished from strial punctures when striae are scarcely impressed. From some angles of view, such specimens do not appear to have striate-punctate elytra. Scutellum large, flat, triangular. *Prosternum* with plastron on a belt along lateral margin that is anteriorly widened to extend to carinae. Carinae widely diverging anteriorly and extending almost to apical margin. *Metasternum* (Fig. 7, D) with disk almost flat. Lateral discal carinae well-developed. Median longitudinal line shallow and narrow. *Abdomen* with sublateral carinae of disk of first sternite not extending to posterior margin in some specimens; in others very nearly reaching posterior margin of disk. Plastron absent on discs of all 5 sternites.

Female: Externally similar to male.

Holotype Male: BRAZIL: Mato Grosso, Porto Velho, viii-ix-1937, H. E. Hinton [my collection].

Paratypes: 185 with same data as holotype; 7, Amazonas, Manaus, ix-1937, H. E. Hinton; 4, Pará, Belem, ix-1937 H. E. Hinton; and 1, French Guiana, St. Laurent, x-1937 H. E. Hinton. Paratypes have been deposited in the collections of the British Museum (Nat. Hist.), U.S. National Museum, Chicago Natural History Museum, and in the Museu de Zoologia, Universidad de Sao Paulo.

Most of the paratypes are very dark brown, and some are almost black. These were preserved in Pampel's fluid from 1937 to 1971. During this time the fluid had dried on several occasions, and the tubes had been refilled. The darker colour of the cuticle of the fluid-preserved specimens is due to this alternate drying and wetting.

Tolmerelmis Hinton, NEW GENUS

Body obvate. Antenna 11-segmented. Maxillary palpi 4-segmented.

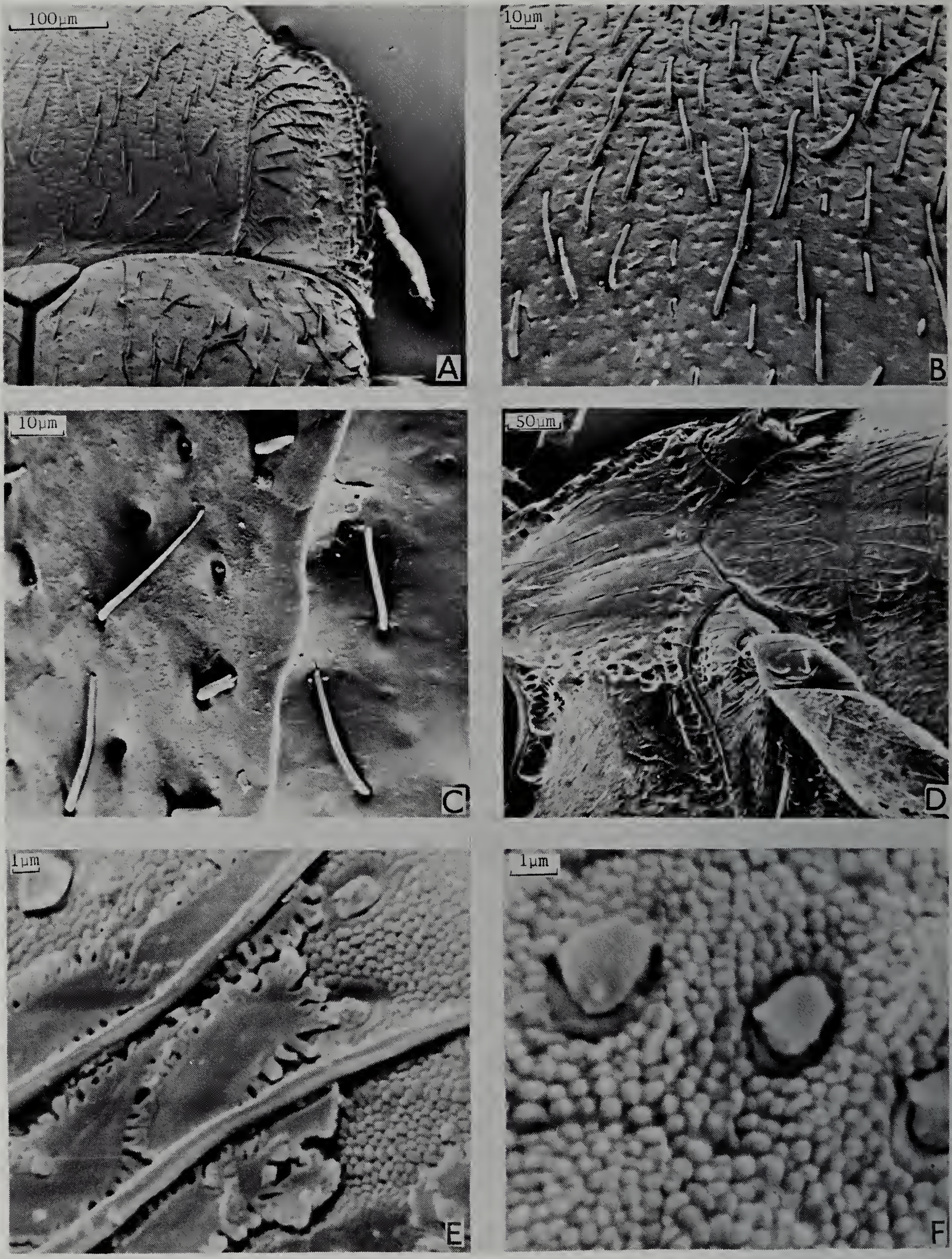


Fig. 7: Scanning electron micrographs of *Tyletelmis mila*, sp. n. A) pronotum; B) disk of pronotum (the reticulate microsculpture between the punctures has been obscured by the deposit of gold-palladium alloy on the specimen); C) sublateral carina on apical one-third of elytra; D) metasternal disk and discs of first 2 abdominal sternites; E) plastron of second abdominal sternite near middle (2 setae of the macroplastron are also shown as well as the granules below the scale-like plastron); F) epipleura showing granules below scale-like plastron.

Pronotum with sublateral carinae well-developed, broad with inner edge sharp, and extending from base to about apical fifth; lateral edge when seen from side not double; disk with a broad, deep, median longitudinal depression extending from base very nearly to apex; with an indistinct and shallow, scarcely noticeable, transverse depression on basal two-fifths. Elytron with 2 well-developed, granulate, sublateral carinae; at base with 1 row of strial punctures between carinae but toward apex with 2 rows between so that outer carina appears to be on seventh interval on basal region and eighth interval on apical region; outer sublateral carina extending to a point opposite posterior margin of second abdominal sternite and inner carina extending to a point opposite middle of fifth sternite; striae with second confined to basal third and third to basal half. Prosternum long, at sides much longer than width of front coxae; process broad between coxae; sublateral carinae well-developed and extending almost to apical margin. Abdomen with sublateral carinae on disk of first sternite. Legs with 2 cleaning fringes on front and middle tibiae and with only 1 cleaning fringe on hind tibiae; posterior cleaning fringe of front tibiae and anterior cleaning fringe of middle tibiae very short; posterior cleaning fringe of middle tibiae exceptionally long (Hinton 1936: Fig. 4). Plastron of microtrichia confined to the side of mesosternum and anterior lower side of metasternum and metasternal episternum.

GENOTYPE: *Heterelmis pubipes* Hinton (1936).

The hypomera, epipleura, sides of prosternum, much of sides of metasternum, and sides of first 3 abdominal sternites have a strong metallic lustre. The surface of the cuticle of these areas has dense granules less than 0.5 μm wide. These granules may be a kind of plastron, but experiments with live specimens are required to show if they hold a film of air against a pressure difference. This type of plastron is, for instance, present on the spiracular gills of the tipulid fly, *Orimagula hintoni* Alex. (Hinton 1968, Fig. 9). The granules are similar to those illustrated here for *Tyletelmis* (Fig. 7, E, F). There is also a very distinct metallic lustre on the pronotum, and here too the surface has similar granules.

COMPARATIVE NOTES: *T. pubipes* was originally placed in the genus *Heterelmis* Sharp (Hinton 1936), but this was done years before the significance of the plastron was known. In *Heterelmis* the disk of the pronotum may be evenly convex or, more usually, have a distinct transverse depression, but it never has a broad median longitudinal depression. In *Heterelmis* a hair-like plastron is present on the head below and behind the eyes, the lower sides of the hypomera, the epipleura, the sides of the pro-, meso-, and metasternum, the sides of all abdominal sternites, and the femora and sometimes also the trochanters.

REFERENCES

HINTON, H. E. 1936. Descriptions and figures of new Brazilian Dryopidae (Coleoptera). Entomologist 69: 283-289.

HINTON, H. E. 1968. Spiracular gills. Adv. Insect Physiol. 5: 65-162.

TRECHUS OBTUSUS ERICHSON IN CALIFORNIA (COLEOPTERA: CARABIDAE)

TERRY L. ERWIN

Entomology Department, Smithsonian Institution, Washington, D. C., 20560.

Lindroth (1961) recorded the European species *Trechus obtusus* Erichson from the Pacific northwest, south to Oregon. He stated that it was introduced into North America and has been found at Boundary Bay, British Columbia, in the company of 3 other Old World species (*Bradycellus harpalinus*, *Harpalus affinis*, and *Pterostichus melanarius*). In a collection of general Carabidae submitted to me for identification by Michael Druckenbrod (illustrator in this department), I found 1 specimen of this species collected at ultra-violet light (the specimen is fully winged although the species is wing-dimorphic) in Niles Canyon, Alameda County, California, 12-IX-71.

Niles Canyon is in the "vicinity of ports" as mentioned by Lindroth, but the species lives in Europe as "an inhabitant of the open country, on meadows &c., also among the leaves under Salix-bushes." Niles Canyon is full of *Salix* of various species and probably provides a similar habitat to that in Europe. Having spent many collecting years (1961-1966) in this area, I strongly suspect that the species is established in the Canyon, but only quite recently. Further study should determine: 1) whether it *is* established in Niles Canyon and environs; 2) what are the differences in population structure (with regard to wings) in comparison with port populations; and 3) what are the associated species.

REFERENCE

LINDROTH, C. H. 1961. The ground-beetles of Canada and Alaska. Part 2. Opusc. Ent., Suppl. 20:1-200.

* * *

BOOK NOTICE

Collecting insects requires an extensive knowledge of geography and general travel information. One of the most interesting series of books on this subject has just come to my attention, and I believe it would be of interest to most readers of the *Coleopterists Bulletin*. They are reasonably priced paperbacks which provide guidance to remote areas and tips on economical savings which will easily repay the purchase price. Space does not permit a review of each of the following 8 volumes, but their titles and chapter headings reflect their contents and usefulness:

Fabulous Mexico, where everything costs less by N. D. Ford. 1972. 11th revised and expanded edition. 192 p., $2.50.

PART I. Inside Mexico—a complete introduction to vacationing, investing, and retiring. Chapter 1) This is Mexico; 2) Mexico's treasure trove of sports and recreations; 3) No passport, visa, shots, or red tape; 4) Mexico's fat investment profits; 5) Mexican real estate; 6) How to have an executive's vacation on a secretary's budget.

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Travel routes around the world by F. E. Tyarks, N. D. Ford, & M. Drouet. 1972 ed. (38th Annual). 127 p., $1.50. The traveler's directory to passenger-carrying freighters and liners. Includes information on

(Continued p. 52)

SOME NEW AND LITTLE KNOWN SPECIES OF MALTHINI FROM THE SOUTHWESTERN UNITED STATES (COLEOPTERA: CANTHARIDAE)

KENNETH M. FENDER

Linfield Research Institute, McMinnville, Oregon 97128

ABSTRACT

Four new species of *Malthinus* and 3 new species of *Malthodes* from the southwest United States are described, as is the allotype male of *Malthinus tricolor* Fender. A revised key to the species of *Malthinus* of North America is included.

INTRODUCTION

Campbell and Marshall (1964) proposed the Ocular Index (O. I.) in their studies of Alleculidae. To obtain this index they divided the width of the head between the eyes at the narrowest point by the width of the head (including the eyes) at the widest point and multiplied the result by 100. To me it seems simpler to multiply the width of the head between the eyes by 100, then to divide it by the width of the head including the eyes. Similar indices of other areas can be usefully employed in some of the Cantharidae. The length of the pronotum × 100 divided by the width of the pronotum gives a pronotal index (P. I.). The width of the pronotum × 100 divided by the width of the head including the eyes gives a head-pronotum index (H. P. I.). Measurements should be at maximum extent except for the width of the head between the eyes. I plan to utilize these indices in this and future studies.

An antennal formula (A. F.) can be utilized also. In the Cantharidae, the comparative lengths of antennal segments 2 to 4, as well as the length to width formula for the intermediate segments (preferably the sixth), are frequently important. Those for segments 2 to 4 are carried to the least common denominator. For example, the formula 4-5-7, 4.5X indicates that segment 2 is four-fifths as long as segment 3 and four-sevenths as long as segment 4, whereas segment 3 is five-sevenths as long as segment 4. The intermediate segments (4.5X) are 4.5 times as long as wide. These ratios are often most important.

Malthinus rothi Fender, NEW SPECIES

(Fig. 1-2)

Black. Head flavous in front of eyes. Pronotum blackish brown, basal and apical margins narrowly testaceous, becoming more widely so toward angles. Apical fifth of elytra light creamy yellow. Apical angles of first four abdominal sternites narrowly testaceous. Legs piceous with knees feebly paler. Pubescence cinereous, fine, sparse and inconspicuous. Length 3.5mm.

MALE. Indices: O. I. 61; H. P. I. 77; P. I. 83; A. F. 11-14-17, 5.5X. *Head* suborbicular, flattened between moderately large and prominent eyes, dull, finely sparsely punctured, becoming granulate punctate on neck; antennae slender extending to tips of wings in repose. *Pronotum* transverse, shining, finely sparsely punctured, anterior margin arcuate, anterior angles rounded, lateral margins arcuate at middle then straight and narrowly converging to apical and basal angles, basal angles obliquely rounded, basal margin arcuate, marginal bead fine. Scutellum apically bilobed, lobes shallowly subtriangular, exposed portion finely closely punctured. *Elytra* shining, each ligulate to rounded apex, sides parallel, subsutural and discal costae feebly elevated, finely rugose-punctate basally, more coarsely rugose medially, pale apices tumid and finely, more closely punctured. Thorax beneath shining, very finely sparsely punctured. Abdominal sternites feebly shining, more coarsely punctured.

FEMALE: Unknown.

Male terminalia (ventral view): sixth abdominal sternite broadly deeply emarginate, apex of emargination arcuate; sides of seventh sternite rapidly sinuately converging to apex, apex broadly deeply emarginate, apex of emargination rounded, lobes thus formed rounded; ultimate tergite and small apical appendage, each semicircular; exposed sides of ventral plate not visible; ventral accessory process spinose, apically split, forks laterally reflexed; (lateral view): sixth sternite subquadrate, apical angles rounded; seventh sternite sub-cymbiform, sides of ventral plate elevated as small whitish semicircular discs; ventral spinose process slender, apically reflexed towards dorsal surface; last tergites normal.

Holotype male: ARIZONA: Cochise Co., S.(outh) W.(estern) R.(esearch) S.(tation), 5 mi. w. Portal, 24-VII-65, 5000′, Vincent Roth, [American Museum Natural History].

Malthinus cuspidatus Fender, NEW SPECIES

(Fig. 3-4)

Black. Head in front of middle of eyes and including antennal sockets, basal two-thirds of basal antennal segment beneath and pronotum rufous. Apices of elytra becoming dark olivaceous. Apices of coxae, trochanters and narrow bases of femora testaceous. Abdomen piceous. Pubescence cinereous, fine, sparse and inconspicuous. Length 2.75mm.

MALE. Indices: O. I. 65; H. P. I. 80; P. I. 78; A. F. 13-17-20, 4.5X. *Head* finely sparsely punctured, more finely so in front of antennae, antennal sockets with inner margins strongly elevated, interantennal area arcuately concave; antennae slender, extending to tips of wings in repose. Pronotum shining, transverse, anterior margin shallowly arcuate, anterior angles rounded, sides strongly descending, feebly arcuately converging to obtusely rounded hind angles, basal margin unevenly arcuate, becoming nearly straight and oblique towards sides, marginal bead moderately fine on apical and basal margins, very fine on sides when viewed dorso-laterally *Scutellum* finely closely punctured, wider than long, apically bilobate, lobes rounded. *Elytra* abbreviated, extending to base of third abdominal sternite, narrowing apically from humeri to tips, apically dehiscent, two evident impunctate discal costae extending from near base to tumid and finely punctured apical fourth, intercostal areas with confused coarser punctures. Thorax beneath shining, sparsely, rather coarsely punctured. Abdominal sternites less strongly shining, finely sparsely punctured.

FEMALE: Unknown.

Male terminalia (ventral view): sixth sternite broadly deeply emarginate, apex of emargination arcuate; seventh sternite nearly as broad as long, sides arcuately converging to more rapidly rounded apices, apex with a moderately deep V-shaped notch; ventral accessory process extending beyond seventh sternite, aciculate; (lateral view): seventh sternite robust, sub-ovate, apex acutely rounded; last tergites normally produced; accessory processes appear to be united, ventral process falcate, produced caudally beyond seventh sternite, connected by a vertical column with dorsal process produced caudally as a short truncate rod.

Holotype male: ARIZONA: Madera Canyon, Santa Rita Mountains, 18-VIII-68, Karl Stephan, [Entomology Research Institute, Canada Department of Agriculture, Ottawa, Canada]

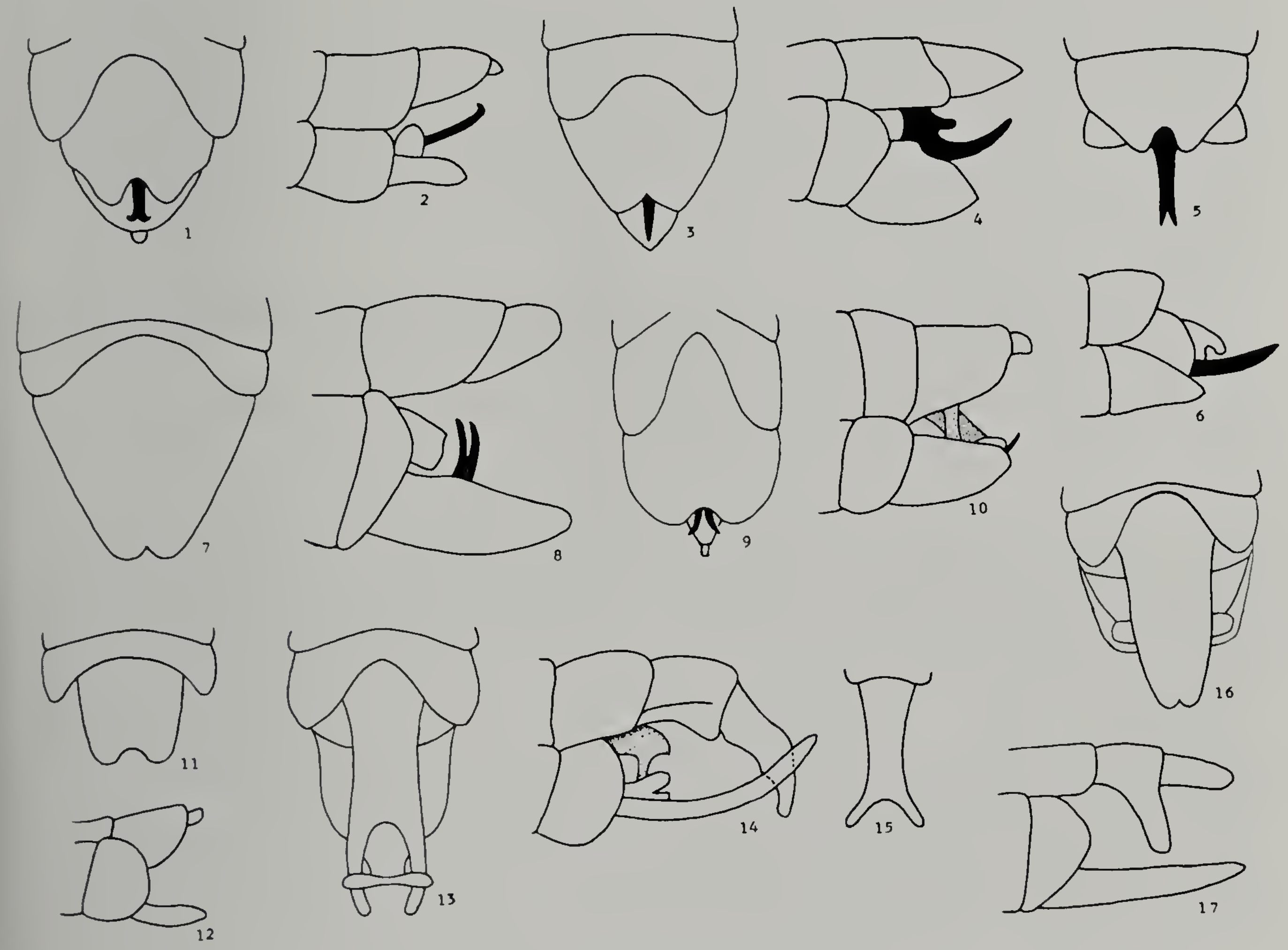

Fig. 1-17: Terminal abdominal segments: 1) *Malthinus rothi*, ventral aspect. 2) same, lateral aspect. 3) *Malthinus cuspidatus*, ventral aspect. 4) same, lateral aspect. 5) *Malthinus sowerestanus*, ventral aspect. 6) same, lateral aspect. 7) *Malthinus tricolor*, ventral aspect. 8) same, lateral aspect. 9) *Malthinus sancticatalinus*, ventral aspect. 10) same, lateral aspect. 11) *Malthodes aciculatus*, ventral aspect. 12) same, lateral aspect. 13) *Malthodes neomexicanus*, ventral aspect. 14) same, lateral aspect. 15) same, caudal aspect. 16) *Malthodes stephani*, ventral aspect. 17) same, lateral aspect.

Malthinus sowerestanus Fender, NEW SPECIES

(Fig. 5-6)

Piceous. Head in front of middle of eyes, basal antennal segment beneath and pronotum flavous. Elytral apices narrowly lemon yellow. Trochanters, apices of coxae, and narrow bases of femora testaceous. Pubescence cinereous, depressed, fine, short and inconspicuous. Length 4mm.

MALE. Indices: O. I. 51; H. P. I. 73; P. I. 78; A. F. 5-6-7, 4X. *Head* feebly shining, much wider than pronotum, finely moderately closely punctured, punctures separated by a little more than their individual diameters; eyes large and prominent; antennae slender, extending to tips of wings in repose. *Pronotum* shining, very finely sparsely punctured, anterior margin arcuate and finely beaded, somewhat reflexed; anterior angles rounded, more strongly reflexed; sides sinuate, feebly convergent to obliquely rounded and slightly prominent hind angles; basal margin arcuate, finely beaded medially, rather strongly reflexed towards sides. *Scutellum* apically emarginate, finely sparsely punctured. *Elytra* feebly narrowed and somewhat dehiscent apically, coarsely sparsely punctured, with sparse fine transverse rugae to the tumid and finely sparsely punctured apices; sutural costa feeble, discal costa strongly elevated and evident. Thorax beneath shining, moderately sparsely punctured with interspersed coarse and fine punctures. Abdominal sternites feebly shining, coarsely, moderately closely punctured, punctures separated by about twice their individual diameters.

FEMALE: Unknown.

Male terminalia (ventral view): sixth sternite feebly arcuately emarginate; seventh sternite transverse, sides rapidly sinuately converging to medially emarginate apex, emargination moderately broadly deeply U-shaped, sides of ventral plate extending laterally as pale subtriangular flanges; ventral spinose accessory process slender, apex with a deep triangular incision, tips acute; (lateral view): ultimate tergite not extended, apical process concealed; seventh sternite subcuneiform; pale ventral plate elevated as an apical disc; ventral accessory process narrow, ensiform; dorsal accessory process basally adhering to ventral process, apically extended and arched.

Holotype male: ARIZONA: Cochise Co., S.(outh) W.(estern) R.(esearch) S.(tation), 5 mi. w. Portal, 22-VIII-63, 5400′, Evans (no initials), [American Museum Natural History].

The specific name for this species was derived from the first 2 letters of each part of the name of the type locality.

Malthinus tricolor Fender

(Fig. 7-8)

Malthinus tricolor Fender, Amer. Midl. Nat. 46(3):522.

MALE. Coloration similar to female, pubescence aureous on pale areas, black on black, length 4mm. Indices: O. I. 44.7; H. P. I. 66; P. I. 79; A. F. 7-8-9, 5X. Head large, much wider than pronotum, dull, finely, very closely punctured, in some areas punctures contiguous forming irregular eroded lines; margin of clypeus arcuate on each side; eyes very large and prominent; antennae slender, extending to tips of wings in repose, feebly tapered from third segment to tips, segments 3 to 10 elongate-subserrate, more evidently so towards antennal bases, interantennal area elevated. *Pronotum* shining, transverse, two-thirds as wide as head, rather strongly arched, anterior margin arcuate, anterior angles rounded, sides feebly arcuate, converging somewhat to obtusely rounded hind angles, basal margin more strongly rounded than anterior, not reflexed or explanate at angles, marginal bead even throughout, disc finely sparsely punctured. *Scutellum* wider than long, subtriangular, apex triangularly notched. *Elytra* abbreviated, extending to about middle of third abdominal sternite, with impunctate sutural, discal and humeral costae, intercostal areas coarsely irregularly punctured to tumid and finely scabrous apical fourth. Thorax beneath shining and finely sparsely punctured. Abdominal sternites shining and more coarsely punctured.

Male terminalia (ventral view): sixth sternite broadly deeply concavely emarginate; seventh sternite sub-elliptical, sides arcuately converging to shallowly triangularly notched apex, 2 tips thus formed broadly rounded; (lateral view): last 2 tergites normally produced; sixth sternite short; seventh sternite unevenly digitate; visible portion of ventral accessory process erect, bifid, each half fang-shaped; dorsal accessory process a vertically aligned, subrectangular plate.

Allotype male from: ARIZONA: Molino Canyon, Santa Catalina Mountains, 8-VIII-69, K. Stephan, [California Academy of Sciences].

This species was previously known only by the holotype female and 2 female paratypes, collected: ARIZONA: St. Xavier Mission, Tucson.

Malthinus sancticatalinus Fender, NEW SPECIES

(Fig. 9-10)

Black. Head, base of first antennal segment and thorax rufous. Basal half or less of trochanters testaceous. Apical angles of second and third abdominal sternites broadly testaceous. Pubescence cinereous, fine and sparse, short and suberect on body above, longer and depressed on sternum and abdominal sternites. Length 4.5mm.

Male. Indices: O. I. 56; H. P. I. 82; P. I. 78; A. F. 5-7-9, 4.4X. *Head* in front of eyes shining and finely sparsely punctured, less shining and more coarsely punctured behind; antennae long and slender, extending beyond tips of wings in repose by about length of last segment. *Pronotum* shining, finely sparsely punctured, transverse, anterior margin broadly arcuate, anterior angles rounded, sides arcuate to about middle, basal half sinuate to obtusely rounded hind angles, basal margin more strongly arcuate than anterior margin, marginal bead thick on basal margin, fine on lateral margins, obliterated on anterior margin. *Scutellum* as wide as long, apically bifid, lobes thus formed rounded, finely closely punctured. *Elytra* abbreviated, extending to base of fourth abdominal sternite, narrowing slightly to weakly dehiscent apices, each with two feebly indicated discal costae, inner costa short, surface finely rugose-punctate basally, becoming more coarsely so medially to feebly tumid and closely, finely punctured apical fourth. Body beneath shining, finely sparsely punctured, a little more coarsely so on abdomen.

FEMALE: Unknown.

Male terminalia (ventral view): apical margin of sixth sternite broadly, deeply, arcuately emarginate; seventh sternite a little longer than broad in exposed portion, sides evenly arcuately merging with apical margin which has a shallow U-shaped median indentation; ventral accessory process furcate, extending beyond seventh sternite, forks arcuately divergent; (lateral view): sixth sternite short, obliquely obovate; seventh sternite stout, unevenly elongate-ovate; penultimate tergite apically narrowed; ultimate tergite a little produced beyond seventh sternite, otherwise normal; ventral plate laterally bent up, produced slightly above edges of seventh sternite near its apical margin; ventral accessory process exposed apically as an arcuate, apically ascending spinose process; dorsal accessory process dual, an exterior, erect, almost parallel sided process, internal to this an oblique, broader parallel sided process.

Holotype male. ARIZONA: Bear Canyon, Santa Catalina Mountains, 6-VII-68, K. Stephan [Entomology Research Institute, Canada Department of Agriculture, Ottawa, Canada].

REVISED KEY TO NORTH AMERICAN SPECIES OF *Malthinus*

1. Elytra coarsely striate punctate 2
1′. Elytra finely, confusedly punctured 4

2(1). Elytra black with apical tumidities dark olivaceous .... *atripennis* LeConte
2′. Elytra testaceous with suture more or less widely infuscate 3

3(2). Male seventh sternite oval and entire .... *occipitalis* LeConte
3′. Male seventh sternite narrowly deeply incised at apex .... *difficilis* LeConte

4(1′). Pronotum finely closely granulose .... *granicollis* Fender
4′. Pronotum finely sparsely punctured 5

5(4′). Pronotum mostly dark 6
5′. Pronotum pale, sometimes with a narrow median dark stripe 9

6(5). Pronotum piceous with 4 discal pale spots and narrow anterior and posterior margins pale .... *quadrimaculatus* Fender
6′. Pronotum not so ornamented 7

7(6′). Pronotum and elytra black .... *georgiensis* Fender
7′. Pronotum castaneous, elytral apices creamy yellow 8

8(7′). Tips of male ventral accessory process acute, divergent and apically reflexed .... *rothi* Fender
8′. Tips of male ventral accessory process rounded, parallel and abutting .... *alexanderi* Fender

9(5′). Head, except mandibles, black .... *chisosensis* Fender
9′. Head, in addition to mandibles, at least in part pale 10

10(9′). Head black behind eyes 11
10′. Head at least partially pale behind eyes 13

11(10). Elytral apices dark olivaceous .... *cuspidatus* Fender
11′. Elytral apices creamy yellow 12

12(11′). In ventral view, apices of seventh sternite of male angulate, apical emargination shallowly subtriangular .... *subcostatus* Schaeffer
12′. In ventral view, apices of seventh sternite of male rounded, apical emargination rounded .... *sowerestanus* Fender

13(10′). Head rufous with a black, transverse, subtriangular interocular fascia 14
13′. Head, except eyes and antennae, entirely pale 15

14(13). Elytra entirely black .... *knulli* Fender
14′. Elytral apices creamy yellow .... *fjellandi* Fender

15(13′). Body beneath rufous .... *tricolor* Fender
15′. Body beneath piceous to black 16

16(15′). Seventh sternite of male apically truncate in ventral view; in lateral view, on apical half and on dorsal surface, a large ovate hinged appendage that may be extended caudally or tucked in under the penultimate tergite .... *bicolor* LeConte
16′. Seventh sternite of male not apically truncate and without a large ovate appendage on dorsal surface 17

17(16′). Ultimate tergite of male normally produced, not bifid as seen in ventral view .... *sancticatalinus* Fender
17′. Ultimate tergite of male bifid in ventral view .... *huachucae* Fender

Malthodes aciculatus Fender, NEW SPECIES
(Fig. 11-12)

Black. Anterior margin of clypeus narrowly flavous; basal antennal segment flavous basally, entire segment flavous beneath. Pronotum flavous, sides near anterior angles black, disc with a vague darkening of median portion covering middle third of pronotum and extending from apical third to but not including basal marginal bead. Elytra piceous. Apical margins of abdominal sternites 2 to 5 narrowly testaceous medially, becoming widely so at apical angles. Apices of coxae and basal half of trochanters testaceous. Pubescence cinereous, fine, sparse and inconspicuous, suberect on body above, decumbent on ventral surface. Length 2mm.

MALE. Indices: O. I. 62; H. P. I. 90; P. I. 79; A. F. 8-9-13, 4.3X. *Head* finely sparsely punctured in front of antennae, more coarsely so behind, not constricted to neck until nearly an eye length behind eyes; eyes small and not very prominent; antennae slender, extending to about tip of abdomen; last segment of maxillary palpi apically aciculate. *Pronotum* nearly as wide as head, shining, finely sparsely punctured, anterior margin straight to rounded and narrowly reflexed anterior angles, sides sinuate to obtusely rounded and narrowly reflexed hind angles, basal margin arcuate, marginal bead moderately fine. *Scutellum* semicircular, somewhat wider than long, finely closely punctured. *Elytra* extending to about middle of fourth abdominal sternite, widest just behind humeri, narrowing to apice, becoming dehiscent beyond middle, moderately punctured, becoming rugose beyond basal fourth to tumid and finely closely punctured apices. Thorax beneath finely, very sparsely punctured. Abdominal sternites microreticulate with occasional groups of large punctures, rather confusedly arranged.

FEMALE. Indices: O. I. 37; H. P. I. 117; P. I. 77; A. F. 8-9-13, 3X. Pronotum flavous with sides near anterior angles black. Similar to male. *Head* narrower than pronotum; eyes smaller and less prominent; antennae shorter, extending to about apex of fifth abdominal sternite. Apical abdominal segments normal for the sex. Length 2.5mm.

Male terminalia (ventral view): apical margin of sixth abdominal sternite broadly arcuately emarginate, emargination extending medially to middle of segment; seventh sternite broadly produced, nearly as broad as long at widest visible portion, sides arcuately converging apically, apex with a broad U-shaped median indentation, tips rounded; (lateral view): last tergites produced in a normal manner; sixth sternite short, apically arcuate; seventh sternite extending nearly as far as penultimate tergite, feebly arcuately ascending apically, subdigitate.

Holotype male, allotype female and 3 male paratypes: CALIFORNIA: Moro Bay, 17-VI-69, K. Stephan. One male and 2 female paratypes: CALIFORNIA: Big Sur, 16-VI-69, K. Stephan. Holotype and allotype [Entomology Research Institute, Canada Department of Agriculture, Ottawa, Canada].

This species belongs in group I of the genus. It differs from any other described species in its coloration of the basal antennal segment, small eyes, length of head behind the eyes, aciculate apical segment of the maxillary palpi and the shape of the seventh abdominal sternite in ventral view. It is probably closest to *Malthodes pictithorax* Fender which has the basal antennal segment entirely piceous, the eyes larger and more prominent, the last segment of the maxillary segment not apically aciculate, the seventh sternite, in ventral view, is evidently longer than wide with the apical notch not U-shaped.

The series from Moro Bay has the median dark area of the pronotum absent to feebly indicated by a rather vague darkening of the median portion. In the specimens from Big Sur, the median black area is clear cut in one specimen, quite evident but vaguely delimited on the others. However there can often be considerable variation in the coloration of the pronotum and these specimens have the other more pertinent characteristics.

Malthodes neomexicanus Fender, NEW SPECIES
(Fig. 13-15)

Black. Shining. Anterior and basal margins of pronotum narrowly paler. Apices of elytra dark olivaceous. Apical margins of abdominal sternites 2 to 5 rather widely testaceous. Apical abdominal sternites dark fulvous, apex of penultimate tergite and all but tips of ultimate tergite dark flavous. Pubescence cinereous, fine, sparse and inconspicuous. Length 4mm.

MALE. Indices: O. I. 50; H. P. I. 92; P. I. 79; A. F. 11-16-21, 4.4X. *Head* in front of antennae shining and finely sparsely punctured; feebly shining and sparsely, a little more coarsely punctured behind and on neck; antennae shining and finely sparsely punctured; feebly shining and sparsely, a little more coarsely punctured behind and on neck; antennae slender, extending to tips of wings in repose. *Pronotum* shining, transverse, finely sparsely punctured; anterior margin nearly straight medially, becoming sinuately indented towards sides to rounded anterior angles; sides nearly straight and parallel to less sharply rounded hind angles; basal margin arcuate; marginal bead fine, becoming thickened at anterior angles. *Scutellum* broader than long, sides sinuately converging to bilobed apex, median apical notch shallowly narrowly V-shaped. *Elytra* extending to apex of fourth abdominal sternite, finely rugose punctate in basal half, becoming slightly more rugose beyond middle to the tumid and finely sparsely punctured apical sixth. Thorax beneath shining and finely sparsely punctured. Abdominal sternites shining, finely sparsely punctured and with short transverse microrugae.

FEMALE: Unknown.

Male terminalia (ventral view): sixth sternite broadly deeply emarginate, apex of emargination evenly rounded; seventh sternite stout, elongate, forked for about apical third, apex of furcation rounded, forks arcuate, apices rounded and feebly converging; tips of ultimate tergite received in furcation at least at rest; (lateral view): seventh sternite arcuate, parallel sided to rounded tips; last tergites produced caudally; ultimate tergite with dorsal surface sinuate, ventral surface uneven; ventral accessory black (as illustrated); (caudal view): ultimate tergite elongate, broadly furcate near apex, forks widely divergent, tips rounded.

Holotype male: NEW MEXICO: The Pine Forest Camp, Lincoln National Forest, 8750′, 13-VII-68, K. M. & W. M. Fender [California Academy of Sciences].

This species is in group VIII of the genus and would key to *Malthodes chiricahuae* Fender. From that species it differs in pronotal coloration, the less stout seventh sternite and the differently shaped ultimate tergite, in both lateral and caudal view.

Malthodes stephani Fender, NEW SPECIES
(Fig. 16-17)

Head black, mandibles testaceous. Pronotum flavous with anterior half of lateral margins black. Scutellum piceous. Elytra and thorax beneath black. Trochanters and apices of coxae testaceous. Apices of abdominal sternites 2 to 5 narrowly whitish; sixth sternite medially, seventh sternite and last two tergites flavous. Pubescence cinereous, fine, sparse and depressed. Length 2.75mm.

MALE. Indices: O. I. 60; H. P. I. 100; P. I. 76; A. F. 5-5-8, 4.4X. *Head* shining, finely sparsely punctured in front of antennae; sparsely, a little more coarsely punctured behind, becoming more closely granulate-punctate between eyes directly behind antennae; antennae extending to tips of wings in repose. *Pronotum* shining, finely sparsely punctured; anterior margin shallowly arcuate; anterior angles rounded; sides sinuate, converging slightly to obtuse hind angles; basal margin more strongly arcuate than the anterior; marginal bead fine on anterior and basal margins, becoming obsolete on sides. *Scutellum* triangular, more than twice as broad as long, finely closely punctured. *Elytra* extending to apex of emargination of sixth sternite, finely sparsely punctured in basal third, becoming feebly rugose-punctate medially, apical fifth tumid and finely sparsely punctured. Thorax beneath shining and finely sparsely punctured. Abdominal sternites less strongly shining, more coarsely punctured.

FEMALE: Unknown.

Male terminalia (ventral view): sixth sternite broadly deeply emarginate, apex of emargination arcuate; seventh sternite elongate, subspatulate, narrowed apically, with a small narrow apical notch, lobes thus formed rounded; (lateral view): seventh sternite falcate; penultimate tergite with sides strongly produced ventrad as digitate processes; ultimate tergite produced caudally as a digitate process.

Holotype male. CALIFORNIA: Tom's Place, Mono County, 13-VI-69, K. Stephan [Entomology Research Institute, Canada Department of Agriculture, Ottawa, Canada].

This species is in group X of the genus. It would key to *Malthodes vanduzeeana* Fender and *M. complexipygus* Fender. In the former, the sides of the seventh sternite (in ventral view) are straight, converging to the apex which has a narrow U-shaped indentation, the tips sharply rounded. In the latter, the sides of the seventh sternite (in ventral view) are sinuate, the segment becoming wider near the apical fifth and the tips are acute with the apical notch triangular.

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* * *

BOOK NOTICE (continued from p. 42)

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(Continued p. 74)

ALTICINAE OF CALIFORNIA, PART I: *EPITRIX* SPP. (COLEOPTERA: CHRYSOMELIDAE)

T. N. SEENO & F. G. ANDREWS

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ABSTRACT

Four species of *Epitrix* are known to occur in California. They are viewed with respect to economic aspects, taxonomy, and distribution. The spermathecae of the females are described and illustrated. Two heretofore difficult to separate species are compared.

INTRODUCTION

The genus *Epitrix* is a widely distributed and economic group of flea beetles of small size and uniform appearance. The known host associations are with the family Solanaceae. Larvae develop below the soil surface, feeding on the root system, and adults live above the surface, feeding on leaves and stems. *Epitrix* is a relatively large genus, with more than 90 species recorded from all continents (except Antarctica).

Three species, *Epitrix hirtipennis* (Melsheimer), *E. similaris* Gentner, and *E. subcrinita* (LeConte) have previously been recorded from California (Leng 1920; Gentner 1944; Blackwelder & Blackwelder 1948). In his 1944 paper on *Epitrix*, Gentner also described *E. tuberis* and listed the distribution as Colorado, western Nebraska, Washington, and Oregon. We confirm this distribution and add the following: Idaho, Arizona, New Mexico, Wyoming, British Columbia, and California.

In recent years, California state survey entomologists have made collections of *E. tuberis*, a serious pest of potato tubers, in Del Norte and Siskiyou counties, California. How it came into California is not known, but it is likely that entry is recent and due to mechanical transport by man. The assumption of recent entry is based on the absence of specimens in collections with dates earlier than 1969. Several dozen collections of *tuberis* have been made in the past few years and all have been from backyard gardens and associated with tomato. Investigations have shown that the seedling stock for these plants came from nurseries in Medford and Ashland, Oregon. The presence of *tuberis* in Medford Valley was noticed in 1966 (Gentner, personal communication), and it is logical that it entered California in the larval stage in soil around seedling tomatos.

The external similarity of *E. tuberis* and *E. similaris* makes separation difficult, but the distinctiveness of the female spermatheca described and illustrated herein, and to a lesser extent the male genitalia, allows easy and positive separation.

This paper is a forerunner of a more extensive review of the genus for North America, so a minimum of synonymical information is presented. Distributional information and comparison of 2 morphologically similar species, *E. similaris* and *E. tuberis*, are stressed.

ECONOMIC IMPORTANCE

All 4 species of *Epitrix* which occur in California are of economic importance. They are primarily associated with solanaceous crops such as potato, tomato, tobacco, and eggplant. Adults intermittently appear on beans (*Phaseolus* spp.), sugar beets, and cucurbits when a solanaceous host is unavailable.

Damage by adults may be characterized as riddling of the foliage with small round holes. Larvae feed on sub-surface parts of the plant and pupate in the soil. In the case of *E. tuberis*, greatest injury is caused by larval damage to tubers, and adult feeding injury to the foliage is secondary (Gentner 1944).

Epitrix larvae have been reported as vectors of organisms or agents that cause potato scab, spindle tuber virus, and rhizoctonia root rot (Leach 1940).

METHODS & MATERIALS

The female spermatheca was removed by breaking off the abdomen of the dry specimen. This was heated in Essig's aphid fluid, carefully cleaned, dissected in hot fluid, and then placed on a microscope slide.

Hoyer's medium, although not as permanent as balsam, was used for a number of reasons. Hoyer's is water soluble and nearly the same viscosity as the aphid fluid, permitting transferral to the mounting medium. This saved time and practically eliminated breakage.

SPECIMENS EXAMINED: over 4,000 *Epitrix* from western United States. More than 2,500 of these were from California. Approximately 15% of all material was dissected and the spermathecae examined. Each locality shown on the distribution maps (Fig. 13-16) represents an identification by examination of gross morphological characters and at least one (up to 15% of the series) spermathecal dissection.

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Special thanks are due to G. A. Samuelson of the Bishop Museum, Honolulu, Hawaii and L. G. Gentner of Medford, Oregon for their critical review of the manuscript.

Genus *Epitrix* Foudras

Epitrix Foudras 1859: 147 (Type: *E. atropae* Foudras 1860 [designated as type by Maulik 1926:133]). Oblong-ovate, convex alticines with 11-segmented antennae, open procoxal cavities, and semi-erect hairs on the elytra. Pronotum with distinct antebasal transverse impression interrupted by longitudinal furrows laterally.

The following names for components of the spermatheca are modified from Samuelson (1966, and personal communication): *appendix* (a), *gland valve* (gv), *pump* (p), *receptacle* (r), *spermathecal duct* (2 parts), *sclerotized spermathecal duct* (sd), and *non-sclerotized spermathecal duct* (nd). The sclerotized portion of the spermathecal duct lies between the receptacle and the gland valve; the non-sclerotized portion is distad of the gland valve.

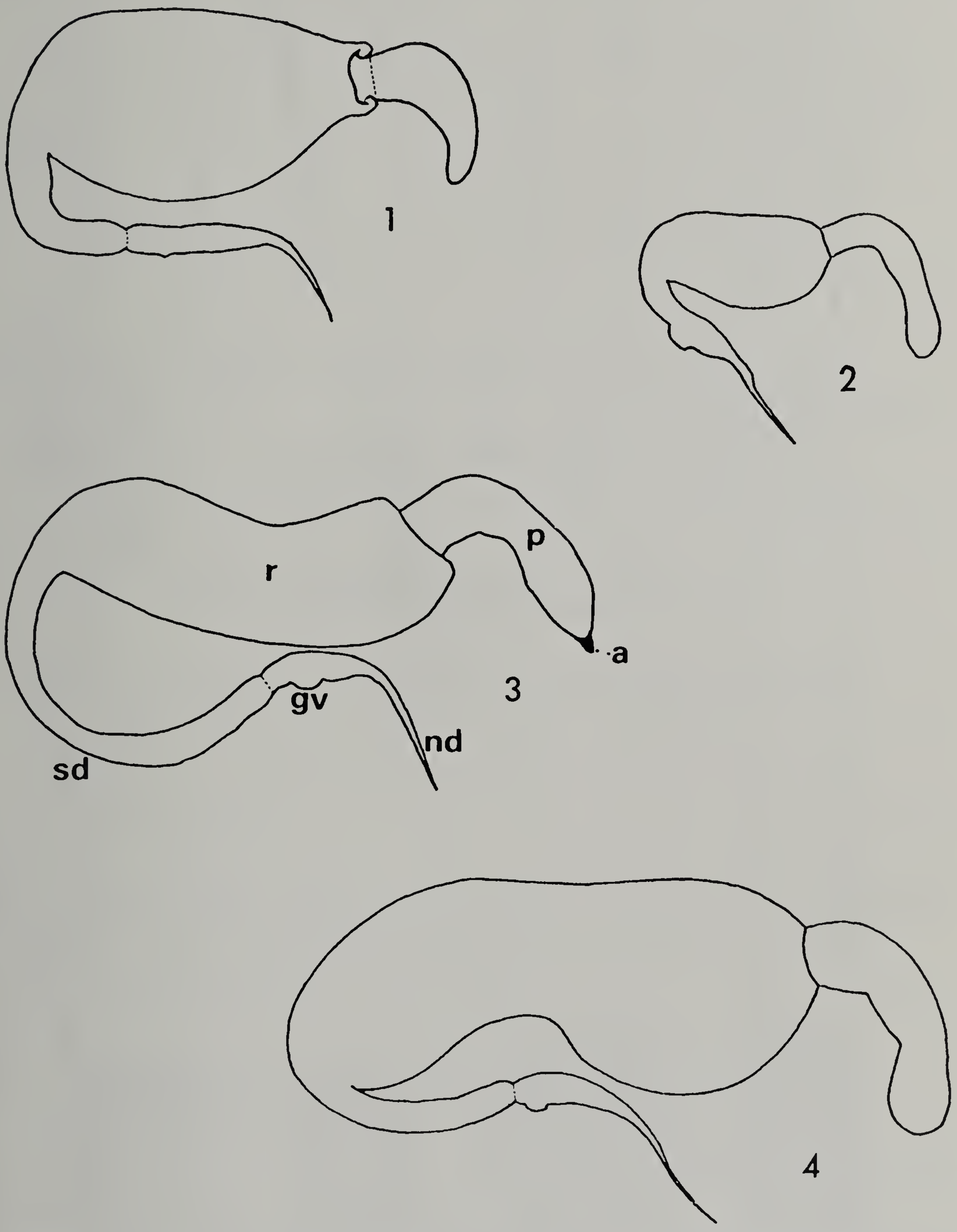

Fig. 1-4, Spermatheca: 1) *Epitrix hirtipennis* (Melsh.); 2) *E. tuberis* Gent.; 3) *E. subcrinita* (LeConte); 4) *E. similaris* Gent. (Symbols identified in text).

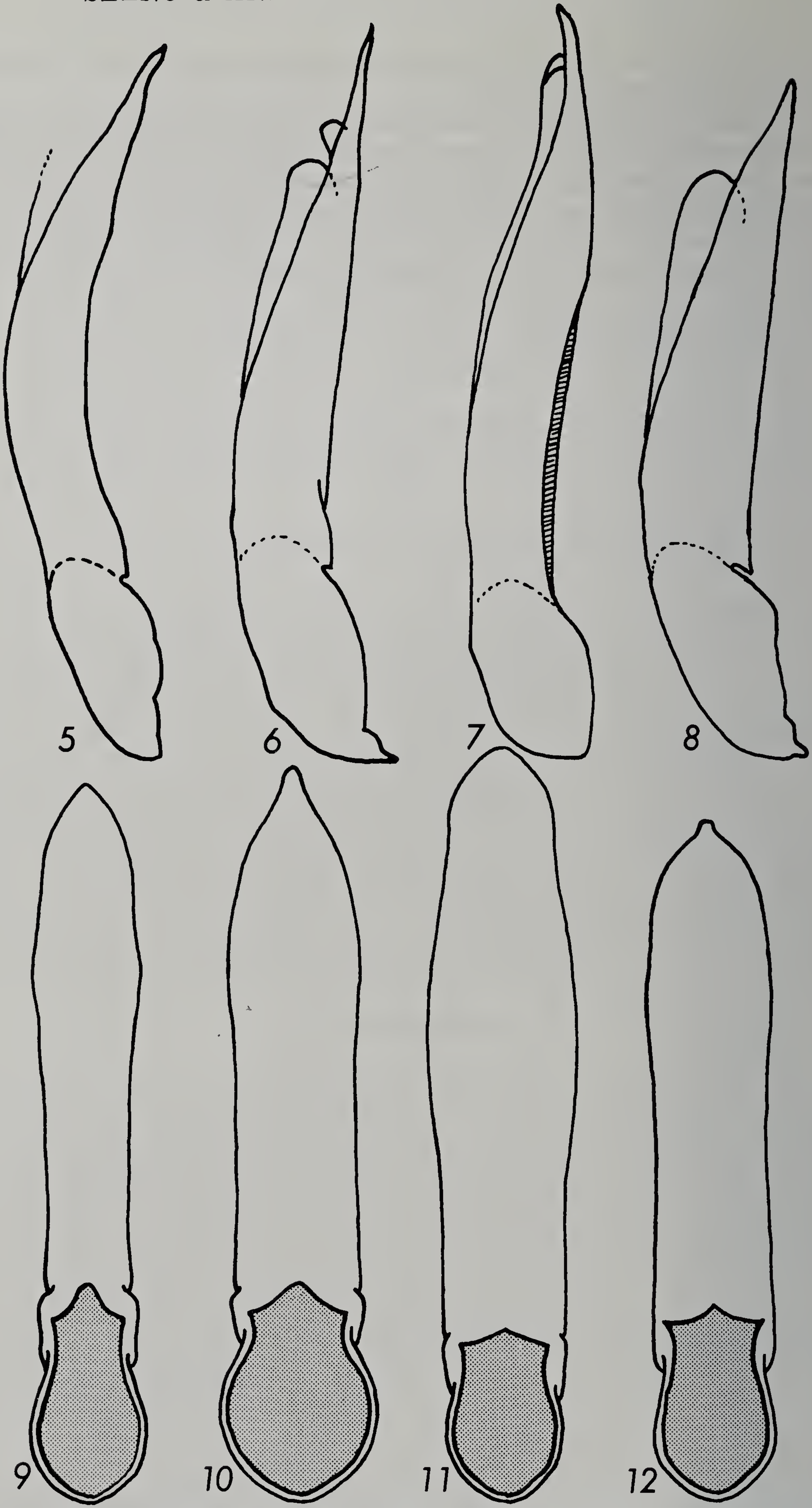

Fig. 5-12. AEDEAGUS (LATERAL AND VENTRAL VIEWS): 5,9 *Epitrix hirtipennis* (Melsh.); 6,10 *E. similaris* Gentner; 7, 11 *E. subcrinita* (LeConte); 8,12 *E. tuberis* Gentner.

KEY TO CALIFORNIA SPECIES OF *Epitrix*
(BASED ON EXTERNAL MORPHOLOGY)

1. Upper surface black or nearly so, lacking brassy metallic luster 2

1′. Upper surface not black; either pale brownish yellow or reddish to dark brown with brassy metallic luster 3

2(1). Eyes prominent, their combined width (at the widest points) when viewed from the top usually greater than 75% of the least interocular distance. Pronotal disc feebly convex, scarcely narrowed anteriorly. Elytral disc moderately convex, lateral margins broadly arcuate. (central to southern California, usually coastal) .... *similaris* Gentner

2′. Eyes not prominent, their combined width (at the widest points) when viewed from the top usually less than 75% of the least interocular distance. Pronotal disc convex, somewhat narrowed anteriorly. Elytral disc only feebly convex and lateral margins somewhat subparallel. (northern California) .... *tuberis* Gentner

3(1′). Elytra brownish yellow. Antebasal impression shallow to feeble, noticeable but not strongly impressed. (throughout California) .... *hirtipennis* (melsheimer)

3′. Elytra reddish to dark brown with a brassy metallic luster. Antebasal impression moderately deep and well defined. (throughout California) .... *subcrinita* (LeConte)

KEY TO CALIFORNIA SPECIES OF *Epitrix*
(BASED ON THE SPERMATHECA)

1. Receptacle oval and entirely without constrictions or sinuations near middle (Fig. 1 & 2) (Points of attachment to the pump may be sclerotized or ringed) 2

1′. Receptacle not oval but constricted and sinuate in the middle (Fig. 3 & 4) 3

2(1). Length of pump less than length of either receptacle or sclerotized spermathecal duct (Fig. 1) ...... *hirtipennis* (Melsheimer)

2′. Length of pump greater than length of either receptacle or sclerotized spermathecal duct (Fig. 2) .... *tuberis* Gentner

3(1′). Receptacle sinuate dorsally, concave or saddle shaped. Sclerotized spermathecal duct broadly arched, the straightened out length sub-equal to length of receptacle. Distal end of pump pointed to form a small appendix (Fig. 3)............ .... *subcrinita* (LeConte)

3′. Receptacle constricted, somewhat peanut shaped. Sclerotized spermathecal duct not broadly arched, the length approximately half the length of the receptacle. Distal end of pump rounded without appendix (Fig. 4) .... *similaris* Gentner

EPITRIX HIRTIPENNIS (Melsheimer)

(Fig. 1, 5, 9, 13)

Crepidodera hirtipennis Melsheimer 1847:165.

Adult: Head and pronotum light reddish brown, thorax and abdomen brownish, elytra brownish yellow with brown band across elytra at center. Antebasal impression feeble. Body length 1.9mm.
Spermatheca: Length approx. 0.26mm. Receptacle oval, without constriction. Point of contact between pump and receptacle heavily sclerotized almost collar like. Gland valve somewhat feeble.

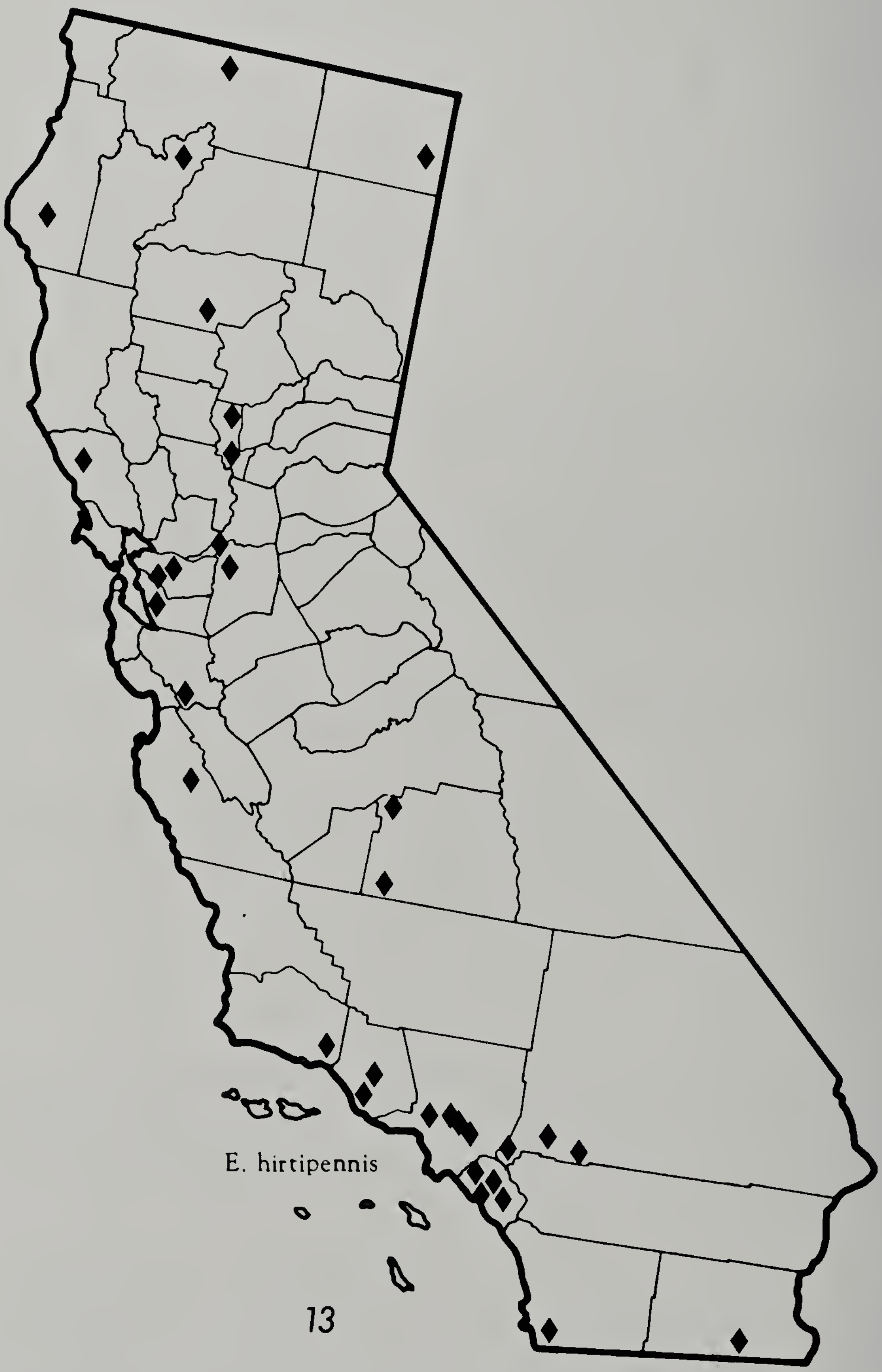

Fig. 13: California distribution of *Epitrix hirtipennis.*

EPITRIX SIMILARIS Gentner

(Fig. 4, 6, 10, 14)

Epitrix similaris Gentner 1944:142-143.

Adult: Black to reddish black. Antenna brownish yellow near base, outer

joints gradually becoming darker. Legs reddish brown becoming lighter towards tarsi; antebasal impression well marked and almost parallel (except near center) with base of pronotum. Body length 2.0mm.
Spermatheca: Length approx. 0.33mm. Receptacle constricted, peanut shaped. Gland valve prominent.

EPITRIX SUBCRINITA (LeConte)

(Fig. 3, 7, 11, 15)

Haltica subcrinita LeConte 1860:68.

Adult: Dark reddish brown with metallic lustre. Antenna yellowish brown near base, outer joints gradually becoming darker. Last antennal segments nearly the color of the elytra. Antebasal impression moderately deep and nearly straight. Body length 2.1mm.

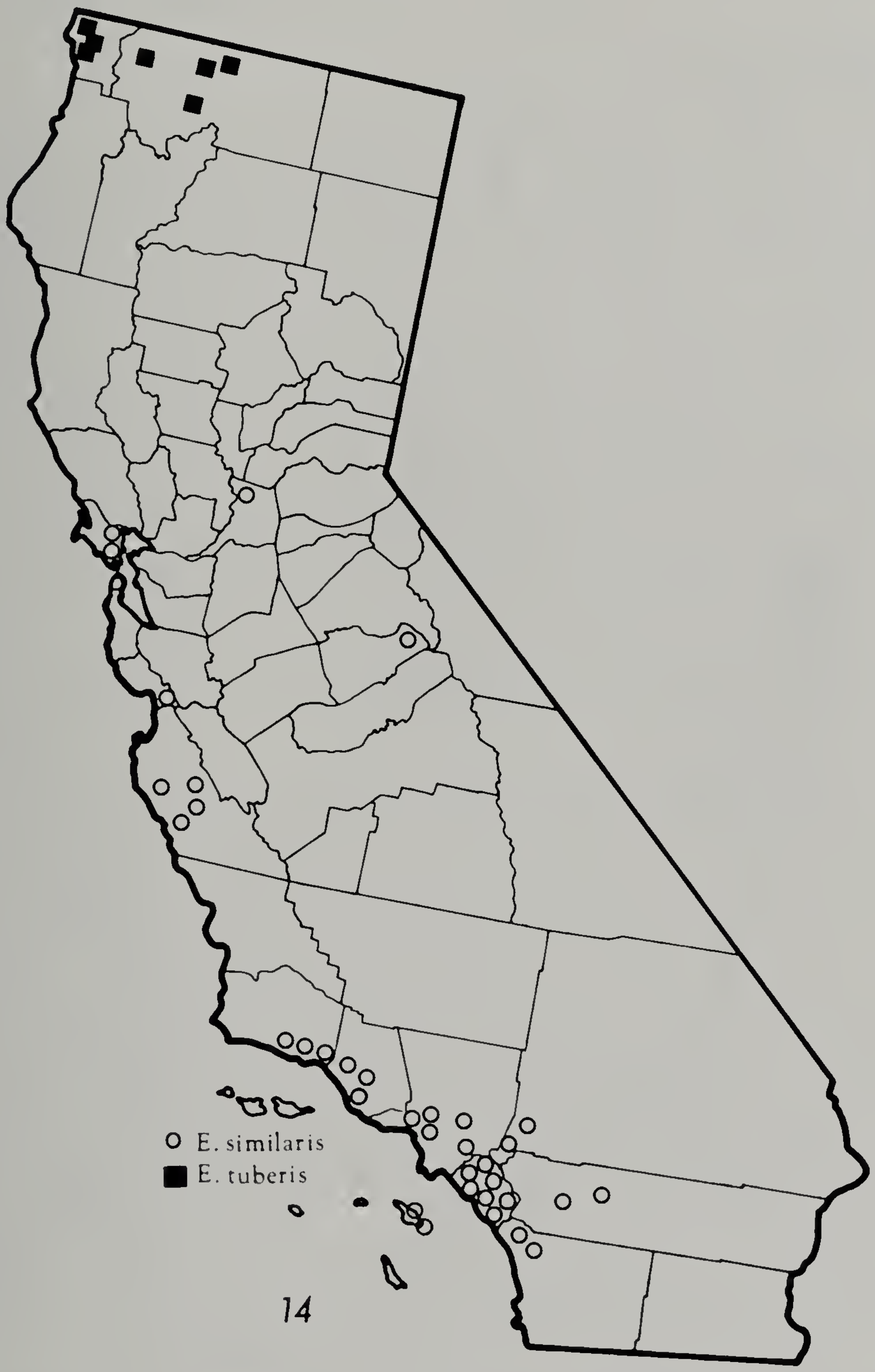

Fig. 14: California distribution of *E. similaris* and *E. tuberis*.

Spermatheca: Length approx. 0.28mm. Receptacle concave, saddle shaped. Gland valve prominent. Sclerotized spermathecal duct curved and so long that it is subequal in length to the receptacle. Distal end of pump with small appendix.

EPITRIX TUBERIS Gentner
(Fig. 2, 8, 12, 14)

Epitrix tuberis Gentner 1944:137-142.

Adult: Black to reddish black. Antenna brownish yellow near base, outer joints gradually becoming darker. Legs reddish brown becoming lighter towards tarsi. Antebasal impression well marked and deep; arcuate and subparallel with base of pronotum. Body length 2.0mm.

Spermatheca: Length approx. 0.19mm. Receptacle oval, without constriction. Pump longer than receptacle or sclerotized spermathecal duct. Gland valve very prominent.

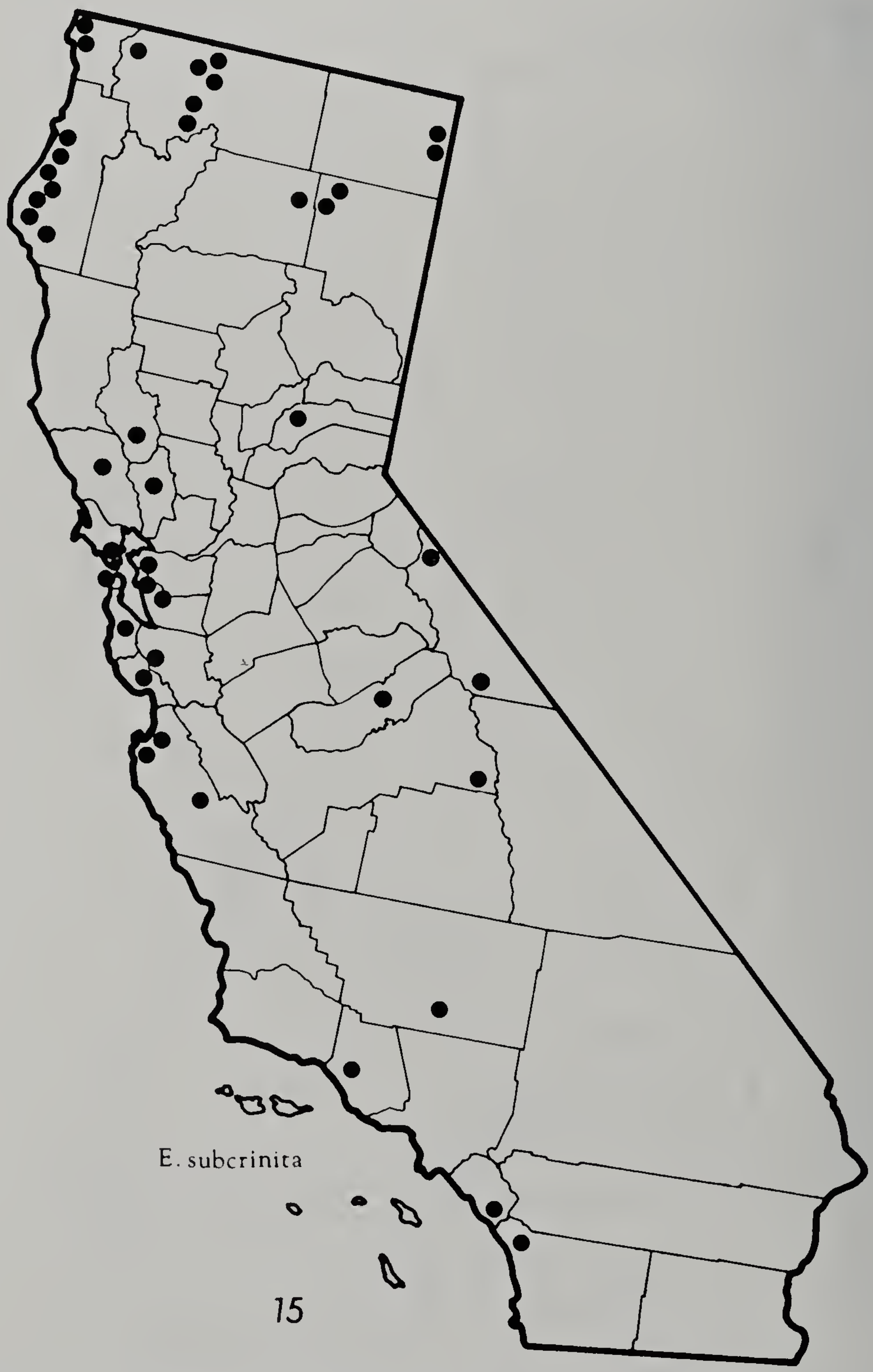

Fig. 15: California distribution of *E. subcrinita*.

Comparison of:

Epitrix similaris Gent.	*Epitrix tuberis* Gent.
DISTRIBUTION: California: Sacramento south to San Diego county, mainly coastal.	DISTRIBUTION: California: Siskiyou and Del Norte counties; north into Oregon, Washington and British Columbia; east to Colorado and Nebraska.
SPERMATHECA: Pump shorter than the receptacle: receptacle constricted in center (peanut shaped).	SPERMATHECA: Pump longer than the receptacle: receptacle not constricted in center (egg shaped).
EYES (viewed from top): Combined width usually more than 75% of interocular distance.	EYES: Combined width usually less than 75% of interocular distance.

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NEW AND INTERESTING RECORDS OF CARABIDAE FROM THE OLYMPIC PENINSULA (WASHINGTON)

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During the summers of 1967 and 1968, I had occasion to make collecting trips in the Pacific northwest and particularly through the Olympic Peninsula. Most of the specimens collected in this part of the country belong to species normally found there, but a few of them are of special interest.

One of the most interesting species is *Broscodera insignis* (Mann.). About the distribution and ecology of this species Ball (1960) wrote: "known only from the pacific northwest and occurs above timberline.", and Lindroth (1961) stated: "In the coastal mountains range of the pacific northwest, S. to Oregon - very rare and local . . ., at Telegraph point (B. C.) the species occurred in a very steep slope facing north, at the margin of a wide snow field. . ." From these quotations it appears that *Broscodera insignis* is a montane species. Hatch (1933) recorded it from Olympic Hot Springs. The capture of 1 living specimen, 25 July 1968 at Neilton in the southwest part of the Olympic Peninsula, at very low altitude and in an area of dense humid rain forest, seems contradictory to this conclusion.

The specimen was taken under a stone in the bed of a dry brook well shaded by the forest, together with *Trachypachis holmbergi* (Mann.), *Agonum ovipenne* (Mann.), *Pterostichus crenicollis* (LeConte) and *Scaphinotus angusticollis olympiae* (Van Dyke). This specimen fits the description of the species, and no differences are noted.

The distribution of *Nebria piperi* (V. D.), is given by Lindroth (1961): "from Washington to Alaska along the Cascade mountains - very local." This does not seem to include the Olympic Peninsula, although Hatch (1939) and Van Dyke (1925) recorded its presence in this area. A fine series of specimens was taken 13 August 1967 along the bank of the Dosewallips River near the border of the Olympic National Park. They were taken among relatively large stones slightly above the water's edge.

Other interesting captures include *Nebria kincaidi* (Schwarz) at the Hurricane Ridge above timber line at the edge of a very small creek in mountain grassland, and *Nebria metallica* (Fischer) and *Pterostichus nigricoeruleus* (V. D.) in Hoh River Valley in rain forest near the river.

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COLLECTING IN EL SALVADOR, WITH PARTICULAR REFERENCE TO SCARABAEOIDEA AND SILPHOIDEA (COLEOPTERA)

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Ottawa, Canada

The coleopterous fauna of El Salvador is poorly known. Only five collecting sites were mentioned in the *"Biologia Centrali-Americana"*, and this neglect has not been subsequently rectified to any extent.* Few coleopterists have more than casually collected there in recent years. Because little has been written about field entomology in El Salvador, we believe that the information we acquired on a recent collecting trip (Apr. 29 to May 15, 1971) may be of general interest.

Introduction

El Salvador is geographically the smallest of the mainland American countries. It lies in northern Central America, bordered on the west by Guatemala, on the north and east by Honduras, and on the south by the Pacific Ocean. Along the eastern two-thirds of the Pacific coast is a fringe of flat coastal plain. Beyond the coast the land is hilly or mountainous, reaching a maximum elevation of 2418 m. at Monte Cristo, with some broad flat interior valleys. The topography is a result of erosive processes working almost entirely on a substrate of late Tertiary volcanic rocks. Throughout much of the country, high, volcanic, cone-shaped mountains of Pleistocene or recent origin dominate the skyline. Rainfall is seasonal, with the rainy season occurring generally from late May to October. August is a "little dry season" having some rain but less than in either July or September. Maximum daytime temperatures (in Fahrenheit) range from the low 90's along the coast to the low 70's at higher elevations.

On this varied tropical land of 8236 square miles lives a population of 3,100,000 inhabitants (1969 estimate, Fact Book). Two-thirds of the people are rural with a density of about 400 per square mile. The economy of the country is based on subsistence agriculture, and consequently the people have a low standard of living. Much of the land, especially the flat coastal plain, is used for crops and grazing and there are a few large, fairly modern farms. However, most of the people support themselves on small land plots using primitive and inefficient agricultural tools and techniques, including slash-burn cultivation.

The conditions in El Salvador, with an agricultural system which leads to ecological instability and habitat destruction (coupled with a high population density), would make a biologist predict poor collecting. The biologically bleak picture was reinforced for us by stories of intensive and

*There is a published list of the insects of El Salvador: Berry, P. A. and M. Salazar V. 1957. Lista de insectos clasificados de El Salvador. Servicio Cooperativo Agricola Salvadoreño Americano (SCASA). Bull. 21:1-134. In it 55 species of Scarabaeidae are listed on p. 42-47. We far exceeded this number in 2 weeks of collecting, so that, at least for our groups, we feel that our statement is correct.

indiscriminate use of insecticides by agriculture, especially on the coastal plain (Janzen 1970).

It was with dim expectation of finding anything more than pest, weed, and trash species that we decided to spend the first 2 weeks of May in El Salvador. We believe it is valuable for us to record our impressions, both to correct the misimpressions that we had beforehand (and that others seem to have) and to record conditions to provide a guideline against which changes may be measured. Also, it is difficult to find collecting sites in some areas and it is hoped that our notes on localities may assist future collectors. The best earlier treatment we know of on localities and habitats in El Salvador is that of Dickey and Rossen (1938). Additional helpful habitat and locality information is in Burt and Stirton (1961).

ACKNOWLEDGMENTS

A number of people assisted us during our stay in El Salvador. We would particularly like to thank Dr. and Mrs. S. Breeland, San Salvador, who not only furnished us accommodations, but tolerated Berlese funnels on the patio and a black-light on the roof. In addition, Dr. Breeland, along with other personnel of the Central American Malaria Research Unit, aided us greatly by taking us to some of the coastal localities, furnishing transport and some equipment. Mr. and Mrs. Stephen Steinhauser, Santa Tecla, were responsible for all arrangements and accompanied us on our visit to Cerro Monte Cristo. Dr. Francisco Cerano and Victor Hellebuyec arranged for transportation through the University in San Salvador for one of our visits to Cerro Verde. The help so freely given by everyone contributed greatly to the success of our trip.

GENERAL CONSIDERATIONS

With the exception of the city of San Salvador, El Salvador is not developed for tourism. Air connections to San Salvador are satisfactory and

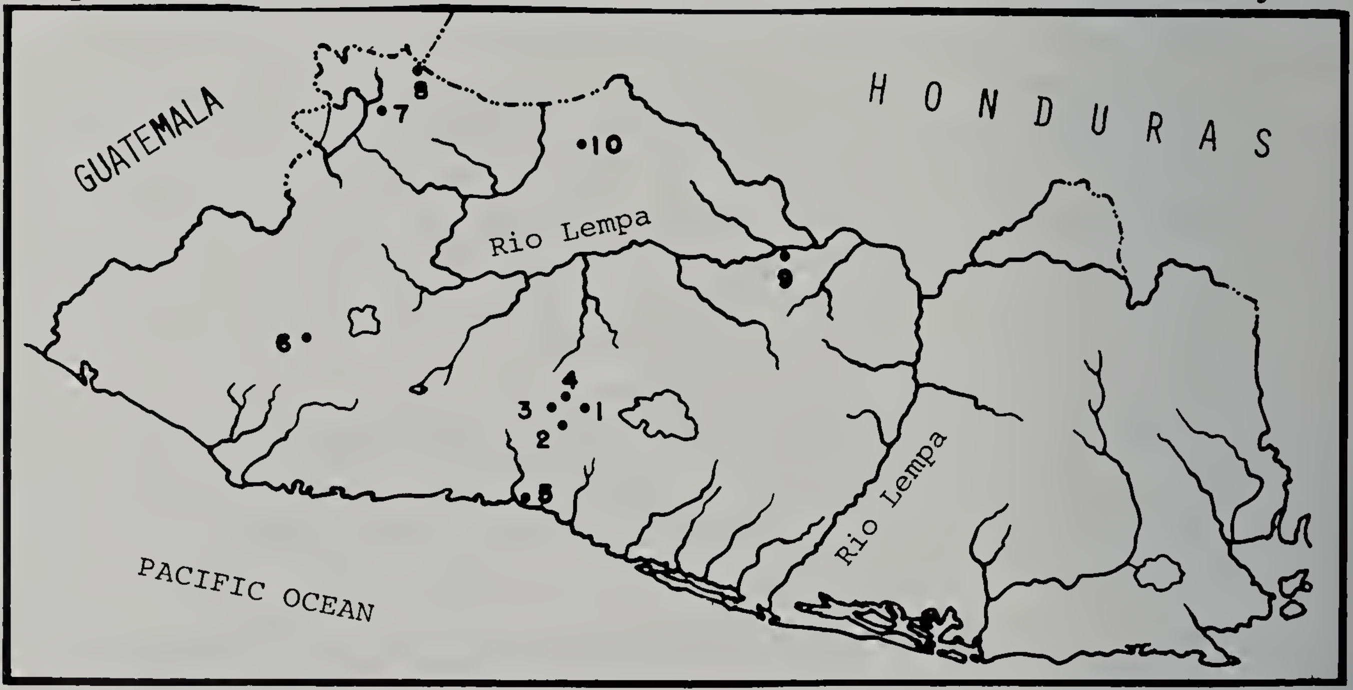


Fig. 1. Map of El Salvador showing collecting localities: 1, San Salvador. 2, Santa Tecla. 3, Los Chorros. 4, Boqueron. 5, La Libertad. 6, Cerro Verde. 7, Metapan. 8, Cerro Monte Cristo. 9, Presa 5 de Noviembre. 10, La Palma.

rental vehicles, including Volkswagons and 4-wheel drive "jeeps' are obtainable at approximately U. S. rates. The rural road system is fair, a V.W. being suitable for all localities visited with the exception of Cerro Monte Cristo and possibly Boqueron. In these 2 areas, 4-wheel drive is desirable and necessary in the rainy season, at least for Monte Cristo.

The localities visited and our impressions of them are influenced by what we collected, which was in turn influenced by the moisture conditions (the rainy season was just beginning and Boqueron and the La Libertad areas were still very dry). Our major efforts were to obtain material, primarily Scarabaeoidea (H.F.H.) and Silphoidea (S.B.P., particularly Silphidae, Catopidae and Leiodidae) that would be useful for our systematic and biogeographic studies. A variety of collecting techniques were employed including beating of vegetation, black-light trapping, Berlese funnel extraction of sifted litter, and pitfall traps baited with carrion and feces. Litter was generally nonexistent (as is frequently the case in lowland tropical areas) or very dry during our visit. Only 4 localities were found with suitable litter conditions and a total of 116 liters, measured after being sifted through ½ inch mesh screen, were extracted in the funnels. A total of 21 pitfall traps were placed in 6 forested areas for a total effective trapping time of 35 days. Five of these days were lost because of human or animal interference with the traps. Also, moonlight (full moon on May 8) and heavy rain interfered with light trapping in several localities.

First, the areas we saw and in which we collected will be described. This will be followed by our evaluations of them, using the map (Fig. 1) for orientation in our discussion.

SAN SALVADOR - SANTA TECLA AREA

San Salvador, # 1 on map, elevation about 900 meters: The capital city which is surrounded by extensive suburban areas. We stayed in Colonia Escalon which is completely built-up, the vegetation consisting almost entirely of lawns and ornamentals. A black-light was operated in the Breeland's yard for 4 nights during our stay.

Santa Tecla (Called Nueva San Salvador on some maps), # 2 on map, elevation about 900 m: A small city situated about 8 km. west of San Salvador. The black-light was operated 1 night in a suburban area approximately 200 feet from the edge of a hillside covered with some native trees and an understory of coffee.

Los Chorros, # 3 on map, elevation about 800 m: This is a bathing and picnicking spot, 4 km. west of Santa Tecla on the road to Santa Ana. The Los Chorros Park is a beautifully landscaped and planted mouth of a canyon, containing bathing pools fed by springs and seepage areas coming from volcanic rock cliffs walling the canyon. In the Park only the trails on the north canyon wall provide access to some natural vegetation. A trail leading up the canyon shortly comes to the end of the park, and continues as the bed of an intermittent-stream. Here the canyon walls rise vertically for 30 m. or more in volcanic rock. The vegetation is disturbed on the canyon bottom by wood cutters and grazing cattle, but the vegetation on the canyon walls is natural. A few tree ferns occur there. The narrow nature of the canyon aids in keeping it cool and more moist than the surrounding hills in the dry season. Butterflies, and presumably other insects concentrate here in the dry season. Sampling techniques consisted of general collecting, baited pitfall traps, and sifting rotting leaves and fig fruits found in damp areas near the base of the cliffs. The pitfall traps yielded a disappointingly small sample of scarabs and one catopid.

Across the highway from the Park is a larger stream canyon with some forest on its steep walls. We were told this is a good collecting area, but did nothing more than look at it. In this same canyon, 1 km. closer to Santa Tecla we operated a black-light 1 evening and were surprised at the large number of beetles, including a total of 31 species of scarabs. In this region the hills are partly cultivated with coffee, with native trees preserved as an overstory providing shade for the coffee.

Boqueron, # 4 on map, elevation 1885 m: This is the summit area of Volcan San Salvador, reached from Santa Tecla by a poor road of volcanic ash and stones. The summit is a popular picnic area. The mountain is mostly planted in coffee, almost to the summit. Only a few remnant trees of the original forest cover are present. A large, fairly old planting of conifers occurs at the end of the road just below the summit. The area was very dry, largely limiting collecting to pitfall traps and black-lighting.

La Libertad area

La Libertad, # 5 on map, elevation 10 m: This coastal city is 24 km south of Santa Tecla on a good paved highway. There are two vegetational types nearby. To the west of La Libertad the coastal highway has been completed in the past few years. It winds around hills that plunge directly into the sea. The soil is generally rocky and extremely poor for agriculture. Much of the vegetation is virgin tropical lowland deciduous or seasonal forest. It had not begun to leaf out by May 14, but a rain on the last day of our visit released numbers of small insects (mostly ants) that swarmed to the blacklight. We would expect much better collecting a week or 2 later.

Exactly 20 km. to the east of the junction of highways 4 and 2 at La Libertad is Hacienda La Cangrejera. There is a large tract of relatively undisturbed lowland tropical evergreen forest here. There has been some selected cutting but perhaps 100 acres of relatively good forest occurs in a strip behind an extensive stand of coastal mangrove. The forest is locally referred to as rain forest, but this term seems poorly chosen because the area does have a definite dry season which had not ended when we were there. The road leading from the highway through the entrance gates can be followed straight back to the south, across fields to the forest, a distance of about 4 km. Pitfall trapping yielded little, demonstrating that the ground fauna was affected by the dryness. This was also true for beating and, to a lesser extent, for black-lighting.

Cerro Verde area

Cerro Verde, # 6 on map, elevation 2000 m: This volcano rises to the west of Lake Coatepeque and lies between Volcan Santa Ana (2381 m) and Volcan Izalco (1830 m). A good all-weather gravel road provides easy access to the summit. There is a nearly completed hotel just below the summit overlooking Volcan Izalco. Izalco was erupting regularly and the hotel was planned so that visitors could view the eruptions. Just as the hotel was essentially finished the eruptions terminated. The hotel has never opened although the grounds and gardens are well kept. Except for the hotel grounds, the top 300 meters of Cerro Verde are well forested with good stands of mixed broadleaves, including oak. There are areas of deep litter covering very porous volcanic soil. Beating, blacklighting, pitfall traps and sifting litter all were quite successful. Moisture conditions were good, rains being fairly frequent there during our visit.

METAPAN AREA

Metapan, # 7 on map, elevation 8-900 m: This town is reached by an all-weather, unpaved road leading north from Santa Ana. On the east side of the road, about 8 km. south of Metapan is an extensive stand of relatively undisturbed, mature deciduous forest. The forest, which was just leafing out on May 10, occurs on a lava flow 1000 to 2000 years old. While we did not collect there, it should be good for flower and leaf feeding beetles, but the lack of mature soil probably precludes any extensive soil or litter fauna.

MONTE CRISTO AREA

Cerro Monte Cristo, # 8 on map, elevation 2300 m: Just at the southern edge of Metapan a dirt road (trail might be a better word) leaves the main road on the right hand side just before a large uncompleted building resembling a theater or opera house. This is the road to Cerro Monte Cristo, also called Cerro Miro Mundo or Trifino. Just after the turn and at several places further on there are forks in the road, and it is best to ask directions to get to the Hacienda Monte Cristo. After the first few kilometers don't take any fork going abruptly down hill. The road itself might be passable to small cars or pick-up trucks during the dry season, but we advise taking a 4-wheel drive vehicle. During the relatively frequent rains, portions of the road that consisted of red clay became very slippery and were difficult to negotiate in a Land Rover. However, the clay dried quickly after a rain. From the Metapan turnoff the first 9 km. of the road traversed heavily cut-over hills. It then entered a mixed pine-oak zone with scattered huts and some coffee on lower slopes. At km 12 and at an elevation of approximately 1200 m and still in the pine-oak zone we operated the black-light for 45 minutes with excellent results. Just beyond, the road crosses several ravines containing temperate deciduous trees such as sweet gum (*Liquidambar*) and hop hornbeam (*Ostrya*). At km 16 at an elevation of 1800 m the pine-oak forest becomes mixed with other broadleaves of unfamiliar genera. One km further the pine ends in a region of cut-over slopes with some reforestation in planted *Cedrus.* This is Hacienda Los Planes. At km 20 the road enters an undisturbed broadleaf cloud forest with oak predominating and tree ferns forming a conspicuous component of the understory. At km 23 at an elevation of 2300 m the road essentially ends at the building of the Hacienda Monte Cristo. Several acres of cut over land surround the buildings, but the surrounding forest is largely undisturbed. It is possible to camp along the road before reaching the Hacienda and it is also possible to make arrangements to stay at the Hacienda. However, food, bedding, and any equipment and supplies should be brought in.

Collecting in general was good for the 3 days we were there, but we were somewhat hampered by frequent rains, particularly in the evening. This would probably be the case during the entire rainy season. Judging from the number of tree ferns and epiphytes, there is probably not a serious deficiency of moisture at any time during the year. However, in the pine-oak zone at lower elevations it was obvious that the rains had just started a week or so earlier (about May 1).

North-Central area

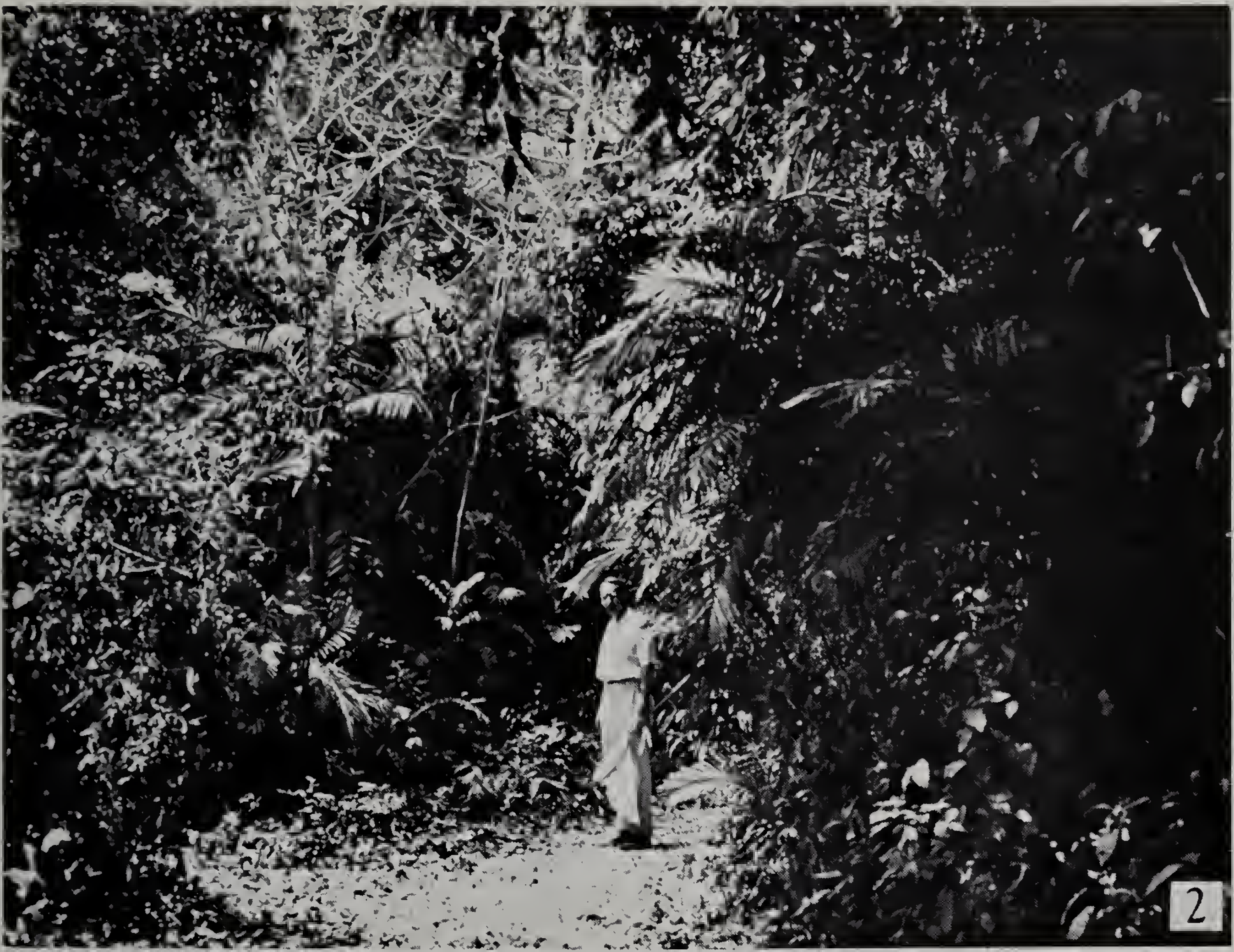
Presa 5 de Noviembre, # 9 on map, elevation about 500 m: This is a dam site reached by a secondary road extending north from the Interamerican highway, the turnoff located to the east of Cojutepeque. The road is paved only to Ilobasco, then gravel. The countryside is extremely cut-over to Ilobasco. Shortly beyond, it winds downward into a hilly, dry interior valley that is now largely grassland with scattered acacias. Near the dam along the impounded lake there is some scrubby deciduous forest, but the area was obviously too dry for collecting during our visit. The actual dam site is under military control and permission would be needed to enter.

La Palma, # 10 on map, elevation about 1200 m: The town of La Palma is in a mountainous area near the Honduran border and is reached by a paved highway running north from San Salvador. On the road between Aguilares and the Rio Lempa, stands of broad-leafed evergreen forest were visible about ½ mile from the highway. They appeared to be good collecting sites but we did not have time to investigate. Before reaching La Palma the road crosses 2 forested mountain ridges (about 15 and 5 km. south respectively). The forest consists mostly of pine and oak with a relatively open understory. The area was fairly dry with little litter, but an attempt to black-light was halted by heavy rains. Under better conditions, collecting should be very good. Also, better collecting should be found near here if the effort is made to take trails to higher elevations.

General Observations and Conclusions

Good collecting localities in El Salvador are difficult, but not impossible, to find. The central and southern portions of the country have been extensively altered by the activities of man, but in many areas a fairly rich fauna has managed to survive. This survival is partly due to the numerous coffee fincas, because the need for shade trees over the coffee necessitates the preservation of canopy trees. This often maintains the mixed species composition of the original forest and preserves the diversity of many groups of phytophagous insects. Also the shade allows survival of the litter and soil fauna that would be eliminated by clearing. We could find no one that knew of any extensive use of insecticides on the coffee.

The extensive use of insecticide on coastal cotton as described by Jan-



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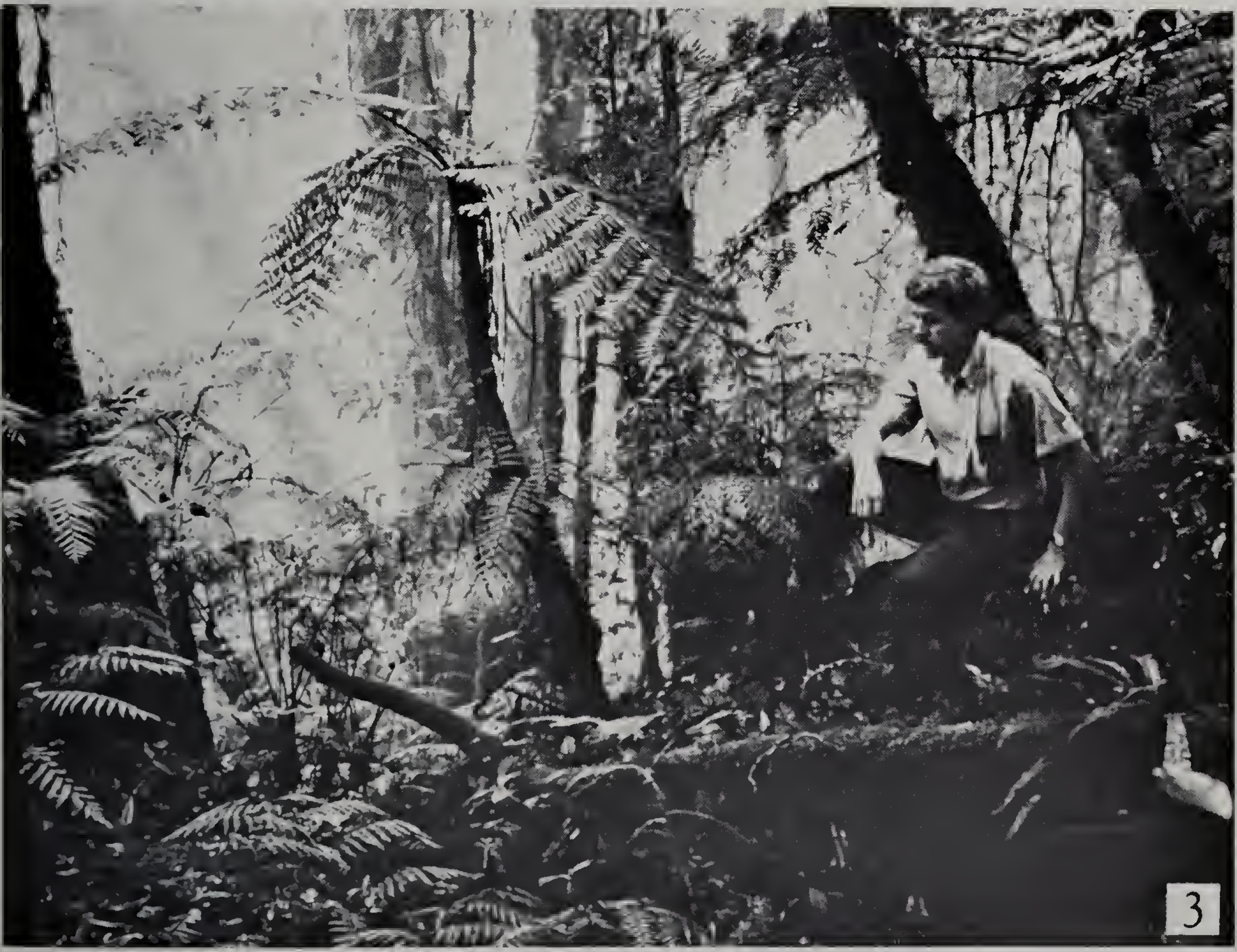

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Fig. 2: H. F. Howden in lowland tropical evergreen forest 20 km. E. La Libertad at the Hacienda Cangrejera.

Fig. 3: S. B. Peck in understory of oak-cloud forest showing tree ferns, moss and other epiphytes on trunks and thick, wet litter, 2300 m. elevation at km. 22 near Hacienda Monte Cristo.

TABLE 1: SUMMARY OF COLLECTING DATA FOR SCARABAEIDAE TAKEN AT BLACKLIGHT.

LOCALITY	GENERIC NAME—(ROMAN) # OF SPP. —(ARABIC) ( ) # OF GENERA	EST. # SPP.	"TRASH" SPP. ( ) # OF SPECIES	TYPE OF HABITAT	NOTES
San Salvador, 900m., 4 nights	(4) II–2;X–2;XI–2;XXI–3	9	(7) (not XI)	well kept suburban lawns & ornamentals	light in well kept backyard
Santa Tecla, 900m., 1 night	(7) II–5;III–1;V–2; X–4;XII–1;XXIV–1;XXI–6	20	(11) II–2;III–1; V–1;X–4;XXI–3	suburban and coffee plantation	light 200 ft. from coffee forest trees
Boqueron, 1800m., 2 nights	(7) II–1;III–;V–1; VI–1;XI–2;XIX–1;XXI–4	11	(2) III (sallei)–1; V–1	very dry-cut over hillside with planted (not native) pines	volcanic soil 3/4 moon
Cerro Verde, 2000m., 2 nights	(5) II–2;XV–1;XXI–3; XXV–1;XXVII–1	8	(0)	moderately wet mixed broad-leaf forest	cool—some rain nearly full moon
C. Monte Cristo, 2300m., 2 nights	(10) I–1;II–2;III–1;IV–1; XI–2;XIII–1;XV–1;XVII–1; XXI–6;XXVII–1	17	(1) III (sallei)	wet mixed forest—tree ferns	intermittent rain
C. Monte Cristo, 1200m., 1 night	(8) II–6;III–1;V–1;X–2; XII–1,XXIV–1;XXI–6; XXVII–1	19	(5) II–2;III–1; V–1;X–1	oak-pine forest moist	3/4 hr. run of light
Los Chorros, 800m., 1 night	(13) II–6;III–2;V–6; VII–1;X–4;XI–2;XII–1; XVIII–1;XXI–3;XXII–1; XXIII–1;XXVI–2;XXVII–1	31	(11) II–2;III–2; V–1;X–4;XXI–2	wet ravine & stream mixed natural forest	1½ hrs. run of light before full moon up
20 km. E. La Libertad, 10m., 2 nights	(8) V–2;VII–2;VIII–1; X–2;XI–1;XVI–1;XX–1; XXI–2	12	(5) V–1;VII–1; X–2;XVI–1	very dry—tropical evergreen forest	1 night nearly full moon
12 km. W. La Libertad, 20m., 1 night	(8) II–2;V–5;VII–1;IX–1; X–1;XXI–1;XXIII–1	13	(4) II–1;V–1; VII–1;X–1	deciduous lowland forest	night after first rain of season
La Palma, 1200m., 1 night	(4) II–2;XI–1;XIV–1; XXI–3	7	(0)	oak-pine forest	light run 1/2 hr. in hard rain

NUMBERS FOR GENERIC NAMES

I–*Ancognatha*; II–*Anomala*; III–*Aphodius*; IV–*Aspidolea*; V–*Ataenius*; VI–*Bolborhombus*; VII–*Bothynus*; VIII–*Canthidium*; IX–*Copris*; X–*Cyclocephala*; XI–*Diplotaxis*; XII–*Enema*; XIII–*Heterosternus*; XIV–*Hoplia*; XV–*Ochodaeus*; XVI–*Onthophagus*; XVII–*Orizabus* (*Cheiroplatys*); XVIII–*Paraspidolea*; XIX–*Pelidnota*; XX–*Phileurus*; XXI–*Phyllophaga*; XXII–*Pleurophorus*; XXIII–*Psammodius*; XXIV–*Spodistes* (*Lycomedes*); XXV–*Strategus*; XXVI–*Trox*; XXVII–*Xyloryctes*.

TABLE 2: SUMMARY OF "SILPHOID" BEETLES COLLECTED IN EL SALVADOR, WITH HABITATS, AND COLLECTING METHODS.

LOCALITY	"BAIT"	TAXA COLLECTED										TRAPS		LITTER	
		Silphidae			Leiodidae										
					Catopinae					Leiodinae					
		Silpha cayanensis	*Necrophorus quadrimaculatus*	*Necrophorus mexicanus*	*Dissochaetus* species 1	*Dissochaetus* species 2	*Dissochaetus* species 3	*Dissochaetus* species 4	*Ptomaphagus spp.*	*Aglyptinus spp.*	*Agathidium*	# of traps	# of days	kg. of litter	liters of litter
Monte Cristo 2300 m	carrion			8			5	6				2	2		
	dung							7				2	2		
	litter						4	1	1		1				58
Monte Cristo 1800 m	carrion	1	2				2	1	1			2	2		
	dung											2	2		
	litter													7.5	25
Boqueron 1800 m	dung				1				5			2	3		
Los Chorros	dung					2						3	2		
	litter									4					13
Cerro Verde 1900 m	dung							48	5	1		2	3		
	carrion							53	5	3		2	3		
	litter										2			5.5	20
La Libertad 20 km E	dung											1	2		
	carrion											2	2		

zen (1970), where 20-30 applications of parathion may be used, may occur in the lowlands east of La Libertad, but we found a fairly rich fauna in the forest to the east of La Libertad. Malaria control measures may have reduced the aquatic fauna, and the control of malaria has certainly sped the destruction of the evergreen tropical forest for agricultural purposes. However, the malaria mosquitoes have now developed resistance to the usual chemical controls, and malaria is again a health problem on the coast.

Our observations indicate that while there has been considerable disturbance by man it is still not as severe as in some other areas such as the valley of Mexico, or the originally forested coastal plain of the eastern United States where native undisturbed forest is equally difficult to find. There is still an interesting and diverse insect fauna in El Salvador. There are probably few species limited to El Salvador, but some habitats may be more difficult to reach in the surrounding countries. The Monte Cristo-Metapan area and probably the area near La Palma contain species restricted to the Guatemalan uplift. The volcanic band, including Cerro Verde and Boqueron, have a somewhat reduced fauna, perhaps due partly to their isolation and partly to relatively recent volcanic activity. Also, their very porous, immature soils may not support some groups. Intermediate elevations with more mature soils, Santa Tecla and Los Chorros for example, support a rich fauna. We suspect this is also true of the coastal areas where we feel that our collecting was hindered by dryness. Table 1 summarizes the number of genera and species of Scarabaeidae taken at the blacklight. This does not include species taken by other methods. A total of approximately 45 species of Scarabaeidae was taken at Los Chorros by blacklight, pitfall traps, and general collecting in a 24 hour period. There are few places in Central America where a similar length of time would yield a greater number of species. Table 2 is a summary of numbers of "silphoid" beetles taken, combined with habitats and collecting methods. These beetles were found to be more numerous at the higher elevations, and in more moist habitats.

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* * *

AN INTRODUCED BUPRESTID IN NEW JERSEY: In looking over material collected by R. L. Jacques, I found a vial of beetles with bright green elytra, shiny cupreous head and pronotum, and 3 to 3.5mm long. Suspecting that they were introduced, I consulted a volume on French beetles where they easily keyed out to *Trachys pygmaeus* Fab. They were collected on hollyhock, along with *Apion longirostre* Oliv., at Irvington, New Jersey, 22-VI-70. In Europe it is found on plants of the family Malvaceae, in which family the hollyhock belongs. (N. M. Downie)

AGGREGATIONS OF *PEROTHOPS WITTICKI* LECONTE (COLEOPTERA:PEROTHOPIDAE)[1]

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ABSTRACT

Several hundred adult *Perothops witticki* LeConte were observed dropping from a live oak tree (*Quercus agrifolia*) in southern California. This and other observations suggest that aggregations of this species may be annual occurrences at specific sites.

The family Perothopidae, represented by a single Nearctic genus *Perothops* and 3 described species, is a relatively unknown group of beetles closely related to the family Eucnemidae (Arnett 1963). *P. cervina* Lacordaire and *P. witticki* LeConte both occur in California while *P. muscida* (Say) is found in eastern North America (Cobos 1965). Blatchley (1910) reported finding adults of *P. muscida* on the trunks and branches of old beech trees. Beyond this recorded observation, there is no further information about the biology and life habits of perothopids. Even the immature stages have so far escaped detection (Crowson 1967).

An aggregation of *Perothops* was encountered 16 June 1969 while I was camping in southern California. The camp, Oakzanita Springs Park, is about 30 miles east of San Diego at an elevation of about 4,000 feet. Vegetation within the park is primarily California live oak (*Quercus agrifolia*), while the periphery of the park consists of typical southern chaparrel including manzanita (*Arctostaphylos*) and California wild lilac (*Ceanothus*). After I arrived at a campsite at 6 P.M., male and female perothopids were observed dropping from the overhead branches of a large California live oak tree. Several specimens were collected and were later determined by R. H. Perry as *P. witticki* LeC.

For the next 2 days large numbers of these beetles were observed as they continuously dropped from the oak tree onto the ground. Although the park area was extensively searched, perothopids were found only below the single oak tree. I conservatively estimate that over 500 adult beetles dropped from this tree during the 3 day period. No flight was observed before or after the bettles dropped, nor was any mating behavior observed. After dropping to the ground, they slowly crawled about, becoming very dusty from the soft dirt of the camp.

The only other report of perothopid activity is an unpublished account provided by E. G. Linsley (*in litt.*). who collected numerous individuals of *P. witticki* about 4 miles south of Railroad Flat, Calavaras County, California at an elevation of 2,800 feet. This area represents an ecotone between the upper Sonoran chaparrel-digger pine formations and transition yellow-pine-oak formation. Immediate surrounding vegetation is principally mature oaks (*Quercus*), yellow pine (*Pinus ponderosa*), and a dense ground cover of mountain misery (*Chamaebatia foliolosa*). In the late morning and early afternoon of 18 May 1969 and 2 June 1970, several *Perothops* were captured at the northwest corner of a building (Douglas fir construction, 20 years old). These beetles, all females, were collected singly on the outside walls of the building as they crawled upward from the ground to a point where they became quiescent. This corner of the building was partially overhung by a large oak tree, but it was not determined if it was the source of the beetles.

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[1] Scientific paper 3818, College of Agriculture, Washington State University. Work was conducted under Project 9043.

It appears that during May and June, adult *P. witticki* seek out aggregation sites in areas which are in some way associated with mature oak trees. Evidence from Linsley's account further suggests that this species may return to the same site at the same time each year. Hopefully this information will be of value to coleopterists interested in locating numbers of individuals and to those interested in studying the biology of perothopid beetles.

I would like to thank Robert H. Perry, Michigan City, Indiana, for his determinations and E. Gorton Linsley, University of California, Berkeley, for providing valuable observational data.

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BOOK NOTICE (continued from p. 52)

$2.50. Extensive listings of remote areas in the U.S. and Canada, many of which are excellent beetle collecting habitats. Chapters are entitled: Six island outposts of Old World Europe; Shangri-Las, USA; The islands time forgot; America's cut rate winter Riviera; Paradise isles of the summer seas; Unspoiled seashore and fishing villages; Escapist isles of the tropic seas; Island idylls in the southern sun; Hideaways steeped in Americana; and Guide to getting away from it all.

Bargain paradises of the World by N. D. Ford. 1971. 15th revised ed. 208 p., $2.50. The title suffices to interest the potential collector in such places as the Azores, Canaries, Madeira, Costa Rica, Mexico, Australia, Corsica, Sicily, Sardinia, Malta, the West Indies, Spain, Ceylon, Japan, Norfolk Island, New Zealand, Balearic Islands, Portugal, Austria, Seychelles, Saba, Colombia, and British Honduras.

Where to retire on a small income by N. D. Ford. 1972. 17th revised ed. 200 p., $2.50. Listings of America's most liveable, worry-free towns.

All about Arizona—the healthful State, where it's great to live and vacation by T. B. Lesure. 1971. 8th ed. 207 p., $2.95.

Florida, a good trip or successful retirement by N. D. Ford. 1972. 15th ed. 256 p., $3.00.

The last 2 books are similar in their travel guide approach to 2 very interesting beetle collecting states. They are recommended as useful additions to any collector's library.

The first 4 books (a $10.00 value) are available for $6.95, or all 8 books (a $20.95 value) are available for $12.95 from: Harian Publications, 1000 Prince St., Dept. 272, Greenlawn, N. Y. 11740. (R. E. Woodruff)

A NEW SPECIES OF *MICROEDUS* FROM THE SIERRA NEVADA MOUNTAINS (COLEOPTERA: STAPHYLINIDAE)

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Abstract

Microedus giulianii n.sp. is described from Big Pine Creek, Inyo Co., California, 8,500 ft. elev. The species is illustrated and a key is provided to distinguish it from the 6 previously known species.

The genus *Microedus* is easily distinguished from members of the tribe Anthophagini by the size and shape of the last segment of the maxillary palpus which is shorter and narrower than the penultimate segment and has the sides straight and nearly parallel (Moore 1966). The genus was erected for *M. austinianus* LeConte (1874). Until now it included 6 species, all of which were treated in Hatch (1957). Hatch said, "These insects live on sand bars and gravel bars by streams, frequently in the mountains." The following key is adapted from Hatch (1957):

Key to the Species of *MICROEDUS*

1. Pronotum and elytra with the entire lateral margin broadly, strongly, widely reflexed .... *fenderi* Hatch
1′. Pronotum explanate only toward the hind angles 2

2(1′). Male with sixth abdominal sternite broadly emarginate behind .... *giulianii* Moore and Legner, n.sp.
2′. Male with sixth abdominal sternite straight along the posterior margin 3

3(2′). Elytra evidently more than twice as long as pronotum .... *laticollis* (Mannerheim)
3′. Elytra not, or only slightly, more than twice as long as pronotum 4

4(3′). Elytra not less than twice as long as pronotum 5
4′. Elytra less than twice as long as pronotum 6

5(4). Elytra obscurely punctured .... *rogersi* Hatch
5′. Elytra evidently punctured .... *austinianus* LeConte

6(4′). Elytra rufo-piceous; legs rufo-testaceous .... *porteri* Hatch
6′. Elytra rufous strongly infused with testaceous on disc; legs testaceous .... *ewingi* Hatch

Microedus giulianii Moore and Legner, NEW SPECIES

Holotype, male.—Color dark piceous except elytra very slightly paler centrally, apices of coxae, trochanters, tibiae, tarsi, mouthparts, and anten-

[1] Staff Research Associate and Associate Professor of Biological Control, respectively.

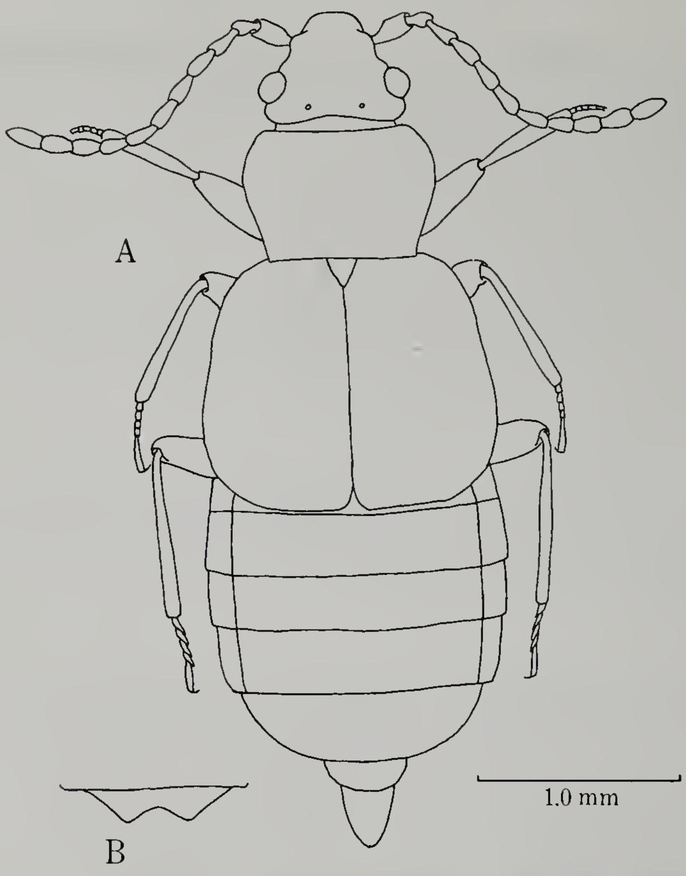

Fig. 1: *Microedus giulianii* Moore & Legner, holotype male; A) dorsal view; B) apex of sixth ventral abdominal segment.

nae rufo-piceous.

Head: as wide as long; clypeal impression strong; nuchal constriction and anteocellar impressions moderately strong. Surface strongly finely microreticulate above and beneath, set with fine sparse pubescence. Eyes prominent. Tempora not as prominent as and a little more than half as long as eyes. Antennae filiform, the segments all longer than wide, the first segment thickest, about twice as long as wide, the second shorter and a little narrower than first, the third a little longer and narrower than second, the fourth a little shorter and about as wide as third, the fourth through tenth of about equal length and each just perceptibly wider than the preceding, the eleventh slightly longer than tenth, gradually obtusely pointed in apical half.

Pronotum: seven-tenths as long as wide, apex four-fifths as wide as base, apical and basal margins nearly straight, angles very narrowly rounded, sides strongly rounded in front, thence narrowed and nearly straight to base. Sides rather narrowly and not strongly explanate in basal half, with a faint central longitudinal groove for most of its length. Surface very finely sparsely punctured, densely and finely reticulate. Pubescence similar to that of head.

Elytra: conjointly one-fifth wider than long, twice as long as pronotum, reaching to posterior margin of first visible tergite, widest near apical third, sides nearly straight but diverging in basal two-thirds, thence broadly rounded into apex; inner apical angles very narrowly rounded. Surface evidently but somewhat shallowly punctured, punctures separated by less than their diameters; finely densely reticulate. Pubescence similar to that of head and pronotum.

Abdomen: as wide and as long as elytra, a little more finely and less densely punctured than elytra. Pubescence similiar to that of foreparts. Beneath sculptured very similar to upper surface. Sixth sternite with posterior margin with an oval emargination in the central third not quite as deep as wide.

Length: 4.0mm.

Female: posterior margin of sixth sternite arcuate.

Holotype male: South Fork of Big Pine Creek, Inyo County, California, 8500', under rocks by creek, July 10, 1971, Derham Giuliani collector. In California Academy of Sciences. *Allotype female* same data as holotype. *Paratypes*: 1 male and 1 female same data as holotype; 1 male and 1 female from Bishop Creek, Inyo County, California, 8500', under rocks by creek, Derham Giuliani collector.

Some specimens have the legs entirely rufo-testaceous. This species is most similar to *austinianus* but can be distinguished easily by the emarginate sixth sternite of the male and by the sides of the pronotum not being sinuate before the hind angles as in that species.

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BOOK REVIEW

An island called California, an ecological introduction to its natural communities by Elna Bakker with photographs by Philip Hyde. 1971. University of California Press, 2223 Fulton Street, Berkeley, Cal. 94720. 357p., 24 line fig., numerous photos. Cloth, $10.00

This is a beautifully produced book with a broad coverage of natural history subjects. The diversity in California ecology is equalled in few areas of the U.S. Such a book will do much to orient the non-Californian as well as suggest new ideas and approaches for field work. Coleopterists who contemplate collecting trips to this State will find their efforts better rewarded by advanced reading of this book.—(R. E. Woodruff)

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A NOTE ON *PARACOTALPA DESERTA* SAYLOR (COLEOPTERA: SCARABAEIDAE: RUTELINAE)

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ABSTRACT

Paracotalpa deserta Saylor is a rare species found in the Colorado Desert region of California and Baja California, Mexico. Specimens were collected in an area of *Larrea* and *Franseria,* and many were impaled on spines of the latter, possibly by shrikes. Known distributional data is summarized.

Paracotalpa deserta Saylor (1940:195) is a rarely collected species which has, as indicated by the recent date of description, escaped detection for many years. Recently, through Dr. R. Flock, El Centro, California, I learned details of the habits and occurrence of this beetle.

In February 1971 a series of 30 individuals were brought to me for determination. Some of the specimens had been recently collected. In company with R. McPeak and A. Gilbert, San Diego, California, Dr. Flock and I returned to the site of collection, and searched for additional examples. The area, located approximately 20 miles west of Calexico, Imperial Co., is in the Colorado Desert region of the Sonoran Desert. Scattered, stunted creosote (*Larrea*) and burr sage (*Franseria*) were the only plants in abundance. The ground was hard packed desert pavement, interspersed with small sandy patches, and laced with sandy-bottomed washes. Efforts to locate the insects during the mid-day were unsuccessful. During the late afternoon, specimens were found at the bases of both *Larrea* and *Franseria*, although those examples collected alive were too few to make any definite host associations. On previous occasions, most specimens were reported by Dr. Flock to be flying in the late afternoon. On my visit to the area, strong winds were blowing, which may have been the reason none were observed in flight.

Most of the approximately 30 additional specimens collected were taken from the apical spines of *Franseria*, where they had been impaled, probably by birds (shrikes?). Most specimens were in good condition, and many were still soft, indicating recent death. Subsequent collecting at the same site has resulted in collection of additional specimens impaled in the same fashion.

The black color of this species, unusual in a diurnal desert scarab, may be of advantage in heat gain from radiant sunlight, since the period of activity is during the winter months, when lowest temperatures in these areas may reach freezing.

Specimens have been examined with the following data: CALIFORNIA: *Imperial Co.*: Coyote Wells, 25-II-1959; El Centro, 15-II-1958; Ocotillo, 26-III-1970, 7-II-1971; Seeley, 9-II-1971; Sunrise Butte (20 mi. W. Calexico), 28-II-1969. *San Diego Co.*; S. End Anza-Borrego, 25-III-1969. MEXICO: *Baja California Norte*: Laguna Salada.

ADDENDUM: On February 11, 1972, at the Sunrise Butte locale, over 100 additional individuals were collected, and 250 additional specimens were taken during the following few days. Beetles emerged in the early afternoon and began a period of active flight lasting for 2 or 3 hours. After the initial flight period, specimens were often found on fleshy annuals scattered throughout the area.

A few females were caged alive in the open and were located by males flying in a zig-zag fashion, low to the ground. This suggests a pheromone is involved. Later in the afternoon, clusters of up to a dozen individuals were located (usually mating pairs with numerous other individuals crawling over them). These clusters were usually associated with the above mentioned annuals.

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SYNONYMY AND AN EMENDATION IN *ELEODES* (COLEOPTERA: TENEBRIONIDAE)

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ABSTRACT

The original spelling for the subgenus *Arpeleodes* (of the genus *Eleodes*) is corrected to now read *Ardeleodes*. *Eleodes bryanti* Blaisdell and *E. palmerleensis* Blaisdell are synonymized under *E. beameri* Blaisdell. Relationships are discussed between the subgenera *Holeleodes, Steneleodes,* and *Metablapylis,* but judgement is reserved until several Mexican species can be compared.

Blaisdell (1937:128) designated the subgenus *Arpeleodes* for a single species from Baja California. Although the spelling *Arpeleodes* appears first in Blaisdell's paper, the spelling *Ardeleodes* follows in 3 places. In addition, *ard-* is a Greek root, whereas *arp-* is not, and it seems apparent that the first spelling is a typographical error. Therefore, *Arpeleodes,* which appears in catalogs (Gebien 1938:63) and check-lists (Papp 1961: 115; Tanner 1961:75), should be replaced with *Ardeleodes* Blaisdell.

In the same paper (p. 132) Blaisdell erected the subgenus *Holeleodes* for 3 species which he described from southeastern Arizona and designated *E. beameri* Blaisdell as type species. The holotype (male) of *beameri* came from the Huachuca Mountains, and the allotype (female) came from the Chiricahua Mountains (Cochise County, Arizona). Blaisdell mentioned 9 paratypes "with same data" without indicating the exact locality. The type series of *E. bryanti* is from the Graham Mountains, Graham County, Arizona (female holotype, male allotype, 7 paratypes). *E. palmerleensis* is based on a female holotype and male allotype from near Palmerlee (Miller Canyon, Huachuca Mountains, *fide* J. N. Knull). Blaisdell separated *beameri* from *bryanti* on the form of the pubescent pads of the protarsus and mesotarsus, while *palmerleensis* was distinguished from the other 2 by its "thicker integuments".

The tarsal pads of numerous specimens we studied vary from the flat, truncate ones of *beameri* to the irregular tufts of *bryanti,* with many intermediates. This is true of series of specimens taken together at 4 different locations. It seems clear that this tarsal variation is intraspecific in nature, perhaps due to wear with age or, in some instances, to matting of the setae. Brief soaking in ether often drastically changes the appearance of the pads. The "thicker integuments" of *palmerleensis* suggest that *bryanti* and *beameri* were described from slightly teneral individuals. Mark-release studies of *E. beameri* in the Chiricahua Mountains show that 10-20% of all individuals are teneral at any given time, and that individuals remain teneral for at least 6 weeks (Doyen and Tschinkel, unpublished data). The high incidence of tenerals was also observed by Bryant in a personal communication to Blaisdell in 1937. For these reasons the names *E. bryanti* Blaisdell and *E. palmerleensis* Blaisdell are placed as synonyms of *E. beameri* Blaisdell.

Blaisdell judged the placement of the subgenus Holeleodes ("should follow *Steneleodes* in our lists") on the basis of the exposed genital segment of the holotype of *E. palmerleensis*. Genitalia preparations of several specimens of *E. beameri* reveal similarities to *Metablapylis* as well as *Steneleodes*. The ovipositor of *beameri* (Fig. 1) is similar to that of *Metablapylis* (e.g. *nigrina* LeC.) in general shape, but the gonostyli are reduced as in *Steneleodes* (e.g. *longicollis* LeC.). The aedeagus of *beameri* resembles that of *longicollis* in the reflexed tips of the apicale and clavae. At present it seems best to reserve judgement on the taxonomic position of *Holeleodes* until several Mexican species can be compared.

Collection records show that *E. beameri* is common from about June to November at higher elevations in the mountains of southeastern Arizona. In addition to the localities mentioned above, specimens are known from Madera Canyon in the Santa Rita Range, Pima County. Two individuals from the mountains west of Durango, Durango, Mexico, suggest that the species also occurs widely in the Sierra Madre Occidental.

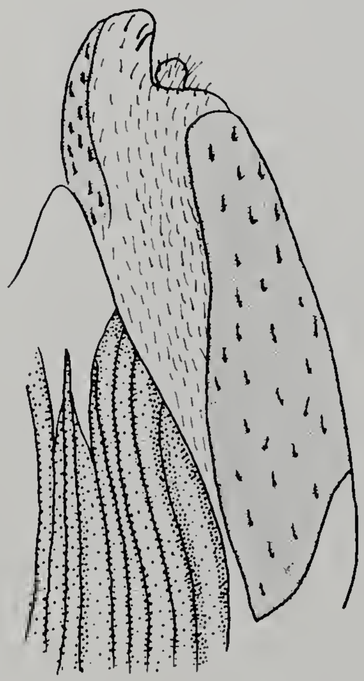

Fig. 1. Dorsal view of the left valve of the ovipositor of *E. beameri* Blaisdell from Rustlers Park, Chiricahua Mountains, Cochise County, Arizona.

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* * *

NOTICE

In order to implement publishing the quantity of manuscripts now on hand, we have increased the size of the *Bulletin* with this issue to 48 pages. The editor solicits comments from subscribers about any aspect of our journal's contents.

(*continued from inside front cover*)

or counties listed. Dates are listed by day, month (in Roman numerals), and last 2 digits of the year. Listing of ecological data is encouraged. Location of specimens should be shown in brackets; if the data is extensive these should be abbreviated as shown and the abbreviations listed in the text.

Any article concerning Coleoptera will be considered. Descriptions of new taxa must contain keys (or be correlated with existing keys) and illustrations. All manuscripts should be typed on 8½x11" opaque white paper with 1 inch margins. They should be typed on one side only and double spaced throughout (including title, footnotes, tables, figure legends, and references). All scientific names should be underlined. Use the following order: title, author, author's address, abstract, body of text, references cited, and figures. All footnotes, tables, and figure legends should be provided on separate sheets and double spaced. Indicate approximate figure and table locations in pencil in the margin of the manuscript.

An abstract should be a concise statement of the facts presented, not *that* they are presented (e.g. list names of organisms, not just that they were discussed or described as new). These abstracts are the key to how your article will be cited in the abstracting journals and should be carefully written.

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SCARABAEIDAE: Studying myrmecophilous and termitophilous Aphodiinae. Request loan of New World material especially. Will sort from general scarab collections or from light trap samples. Robert E. Woodruff, Fla. Dept. Agr., P. O. Box 1269, Gainesville, FL 32601.

HYDROPHILIDAE: Presently revising the genus **Hydrochus** from North, South, and Central America, including the Antilles. Request loan of any material from the Western Hemisphere. John L. Hellman, Ent. Dept., Univ. Maryland, College Park, MD 20742.

TENEBRIONIDAE: Building world-wide reference collection. Will purchase or exchange other Coleoptera. Especially desire immature stages. Kirby W. Brown, Peabody Museum, Yale Univ., New Haven, CT 06520.

HELODIDAE: Revising **Elodes**, need material from NW, W, SW, & S. Will pay postage. Prefer wet material, but mounted or dry OK. Desire larvae also. G. G. Kennen, 381 N. Central Ave., Ramsey, N.J. 07446.

CERAMBYCIDAE: Longicornes du Laos by Gressitt, Rondon, and Breuning. Pacific Insects Monograph 24, 1970, 651 p., 102 pl. (2 color), maps. Over 1000 species illustrated. $17.50 hard cover; $16.00 paper. Bishop Museum Press, Box 6037, Honolulu, HI 96818.

WORLD RESEARCH DIRECTORY: Richard L. Jacques and Dr. Ross H. Arnett, Jr. are preparing a world list of **current** research projects on Coleoptera. A volume will be published as a companion to the recently published "Directory of Coleoptera Collections." Anyone wishing to have a research project listed should write to R. L. Jacques, Dept. of Entomology, Purdue University, Lafayette, Indiana 47907. Forms will be provided.

CLEROIDEA: Conducting world-wide research on internal anatomy. Will exchange North and Central American groups for liquid (10% Formalin, etc.) preserved Cleroidea. Building world reference collection of Cleridae; will purchase or exchange. Ginter Ekis, Dept. Ent. & Econ. Zool., Rutgers, Univ., New Brunswick, N.J. 08903.

SCARABAEIDAE: Wanted, various species of **Megasoma**, male and female, major and minor forms. Will exchange pairs of **M. pachecoi**. Terry W. Taylor, 8529 Norwood Place, Rosemead, CA 91770.

OEDEMERIDAE: Specimens needed for World Revision now under way. Need especially material from Africa, Asia, and South America. Ross H. Arnett, Jr., care of Florida State Collection of Arthropods, P. O. Box 1269, Gainesville, FL 32601.

CICINDELIDAE: Interested in obtaining specimens of **Cicindela hirticollis ponderosa** Thoms. from area of Veracruz, Mexico. Will exchange other Coleoptera. R. C. Graves, 627 Crestview, Bowling Green, Ohio 43402.

INSECT WORLD DIGEST: A new monthly magazine for entomologists, containing news, views, subject bibliographies, etc. For more information write: IWD, P. O. Box 4068, Tallahassee, FL 32303.

FOR SALE: Malaysian and Indonesian Coleoptera and Lepidoptera (over 900 species), including horned rhinoceros, stag, and long-horned beetles; send for list and prices. Sim Yam Seng, 21 Joon Hiang Rd., Singapore (19), Malaya.

DYTISCIDAE (Bidessines): Revising genera **Anodocheilus** and **Neobidessus** for tropical America. Will sort from general collections or light trap material, but promise only generic determinations of other Dytiscidae. F. N. Young, Dept. Zoology, Indiana University, Bloomington, Ind. 47401.

SCARABAEIDAE: Working toward a world revision of the Anomalini. Specimens and records needed from all areas, by loan, purchase, or general exchange. Identifications by arrangement, correspondence invited. R. W. L. Potts, California Acad. Sci., Golden Gate Park, San Francisco, CA 94118.

WANTED: One copy of "Catalogue of the Coleoptera of America, north of Mexico" by C. W. Leng, 1920. P. P. Shubeck, Biology Dept., Montclair State College, Upper Montclair, N. J. 07043.

COCCINELLIDAE: North American specimens and locality records of **Coccinella undecimpunctata** L. required for distribution study of this species. M. Y. Watson, Dept. Biology, Laurentian Univ., Sudbury, Ontario, Canada.

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REPRINTS DESIRED: Now working on the interpretation and integration of available evidences on phylogeny in construction of a phylogenetic classification of Coleoptera. Reprints are requested from specialists in all families. Mohammad Abdullah, Zoologische Staatsammlung, 8 Munich 19, W. Germany.

CARABIDAE: Need material for study of New World **Philochtus** (Bembidiini) including **Cyclopha**. G. G. Perrault, 138 Rue Houdan, 92, Sceaux, France.

WANTED: H. C. McCook. 1882. The honey ants of the Garden of the Gods, and the occident ants of the American plains. State condition & price. W. H. Clark, 534 Roberts St., Reno, NV 89502.

LUCANIDAE: Buy, sell, exchange all species. Also wanted: collection data and World literature on the family. Chris Adamson, 2030 Bancroft Way No. No. 5, Berkeley, CA 94704.

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THE COLEOPTERISTS BULLETIN

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THE COLEOPTERISTS BULLETIN

(Founded 1947 by Ross H. Arnett, Jr.)

The **Coleopterists Bulletin** is published quarterly, beginning in March, by the Coleopterists Society. All manuscripts, editorial questions, or business matters should be sent to the editor: Dr. Robert E. Woodruff, Florida Department of Agriculture, P.O. Box 1269, Gainesville, Florida 32601.

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Manuscripts will be considered from any authors, although those from members of the Coleopterists Society will be given priority. It is suggested that all prospective authors join the Society. All manuscripts should conform to instructions in the **Style Manual for Biological Journals** (3rd Ed.) prepared by the Committee on Form and Style of the Conference of Biological Editors, and published by the American Institute of Biological Sciences, 2000 P Street NW, Washington, DC 20063.

The following exceptions are noted: 1) All geographical names are to be spelled out, 2) use words, not symbols, for male and female, 3) use numerals throughout, except to begin a sentence, 4) entomology, -ical, -ist, etc. are to be abbreviated Ent. in literature citations.

Specimen label data should be listed in the following manner: MEXICO: State of Veracruz, Fortin de las Flores, 10-VIII-70, I. B. Jones, under bark of **Pinus moctezumae**, 7000ft. [USNM] (2). The number in parentheses indicates the number of specimens. Geographical names are listed in order with largest units first, with states, departments, provinces, parishes, and/

Continued inside back cover

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LARVAE OF THE FAMILIES OF COLEOPTERA: A BIBLIOGRAPHIC SURVEY OF RECENT PAPERS AND TABULAR SUMMARY OF 7 SELECTED ENGLISH LANGUAGE CONTRIBUTIONS.

J. F. Cornell
Allen Science Research, Inc.
2029 Shenandoah Ave., Charlotte, N.C. 28205

Abstract

This paper summarizes the current knowledge of nearly 200 families of beetle larvae; indicates known illustrations, descriptions, and keys for each; and presents a selected list of 183 references. Page and figure references are provided for 7 recent, comprehensive, and readily available publications.

Introduction

Although there are many papers and books in which Coleoptera larvae are described it remains a problem quickly to locate descriptions, keys, and figures of examples of the larvae of the nearly 200 recognized families of beetles. One must perform a fairly extensive literature search simply to determine whether any larval form for a family has yet been described. This paper has 3 aims: (1) to summarize, in an easily visible form, the current knowledge of the families of Coleoptera larvae; (2) to indicate sources for illustrations of the described larvae, and where possible, of English language descriptions and keys to known larval types; and (3) to present a selected list of references to the larval forms of each family.

Several older papers, not treated in detail in this review, deserve special mention as sources for figures and descriptions; Perris (126), Schiodte (146), and Verhoef (170). Among the papers presenting keys to many families, but not treated here are: Blair (26), Chang (35), Esaki *et al.* (62), Gilyarov (69), Rymer-Roberts (137) and Viedma (172).

Information on rearing and preserving beetle larvae can be found in many papers, in particular: Peterson (127), Van Emden (56), and Walsh and Dibb (178).

Boving and Craighead (29) and others have treated the subfamilies of some Coleoptera families (*e.g.* Chrysomelidae, Colydiidae, Curculionidae) as separate families, basing their decisions on larval characteristics. Since lumping these subfamilies back into broader, more conservative, families would decrease the information and obscure alternative taxonomic interpretations, such cases are treated below as the original author indicated and are cross referenced to the family in its broader interpretations.

This paper is arranged in 2 parts; (1) a tabular summary of descriptions and illustrations of the larvae of the beetle families of the World (Table 1); (2) a selected bibliography. The references are selected on the basis of comprehensiveness or special interest, and generally, they do not duplicate those cited in the following papers: Brues *et al.* (32), Beutenmuller (24), Peterson (127) and Wade (177). Most of the papers published after 1950, and many earlier ones may be obtained on micro-film or photostat from the National Agricultural Library.

Table 1 summarizes 7 important English language works dealing with Coleoptera larvae: Arnett (4), Böving and Craighead (30), Chu (38), Crowson (41), Peterson (127), Van Emden (57, 58). These 7 were chosen because they are comprehensive, recent, and available to most workers. Entries are arranged by: (1) family name, (2) reference source by author, (3) page and plate or figure numbers within the reference, (4) reference by number to any additional papers in the list of references, and (5) cross-reference to other names commonly used for the family. The cross-references to family names are based on Arnett (3-4). Larvae that are not presently known to me to be described are so indicated, as are those whose descriptions are inadequate.

Acknowledgements

I thank Mr. J. R. Pinson, Appalachian State University, for locating and checking some of the recent references. I appreciate the help of Dr. P. O. Ritcher, Oregon State University, for suggesting this project and contributing many references for it. Thanks are due Dr. M. H. Farrier, North Carolina State University, for reading the rough draft, and to Dr. H. H. Neuzig, North Carolina State University, for his suggestions on the manuscript and for supplying many references on beetle larvae. Finally, I thank Mrs. Ella Austin, for typing the final drafts.

Table 1

Numbers in parentheses following author's name refer to page or figure reference; those preceded by # are the numbers in the references cited section.

Acanthoceridae: (see also Scarabaeidae), Böving & Craighead (52), Crowson (29).
Aderidae: (undescribed).
Aegialitidae: (see Salpingidae).
Alleculidae: Arnett (702), Böving & Craighead (42, pl. 56), Chu (116), Crowson (115), Peterson (18, 25, C4, C7, C46), Van Emden #57 (219, 220, 262); see also #162.
Amphizoidae: Arnett (183), Böving & Craighead (17, pl. 7), Chu (78), Crowson (6), Peterson (8, 25, C40); see also #51, 169.
Anaspididae: (see also Melandryidae), Böving & Craighead (39, pl. 47).
Anisotomidae: (see Leiodidae).
Anobiidae: Arnett (567) Böving & Craighead (62, pl. 101), Chu (119), Crowson (77), Peterson (8, 26, C2, C5, C10, C16, C28), Van Emden #57 (212, 215, 264, f.50); see also #28, 168.
Anthicidae: Arnett (747), Böving & Craighead (39, 60, 74, pl. 46), Chu (111), Crowson (135), Peterson (17, 26, C52), Van Emden #57 (218, 260, f. 26).
Anthribidae: Arnett (959), Böving & Craighead (66, pl. 117), Chu (128), Crowson (156), Peterson (7, 8, 65, C26, C27), Van Emden #57 (211, 212, 264, f.51); see also #107.
Apionidae: (see also Curculionidae), Böving & Craighead (67, pl. 120), Chu (127), Crowson (158), Peterson (78).
Attelabidae: (see also Curculionidae), Böving & Craighead (66, pl. 118), Chu (127), Crowson (158).
Belidae: (see also Curculionidae), Crowson (156).
Biphyllidae: Arnett (789) Crowson (93).
Boridae: (see also Salpingidae), Böving & Craighead (41, 60, pl. 48, pl. 55) Crowson (117).
Bostrichidae: Arnett (581), Böving & Craighead (62, pl. 101), Chu (120), Crowson (77), Peterson (10, 27, C28), Van Emden #57(215, 264) Van Emden #58 (267), f.27, f.28, f.33) see also #105.

Brachypsectridae: Arnett (529), Böving & Craighead (13, 46, pl. 74, pl. 75) Chu (96), Crowson (65).

Brathinidae: Undescribed.

Brentidae: Arnett (967), Böving & Craighead (15, 66, pl. 118), Chu (125), Crowson (158), Peterson (8, 27, C58).

Bruchidae: Arnett (951), Böving & Craighead (15, 63, pl. 103), Chu (121), Crowson (143), Peterson (7, 28, C29), Van Emden #57 (212, 215, 264, f.54).

Buprestidae: Arnett (481), Böving & Craighead (13, 49, pl. 80), Chu (94), Crowson (58), Peterson (7, 28, C13), Van Emden #57 (253, f.44), see also #1, 9, 10.

Byrrhidae: Arnett (451), Böving & Craighead (12, 43, pl. 61, pl. 62), Chu (90), Crowson (52), Peterson (9, 29, C5, C7, C30), Van Emden #57 (215, 217, 226).

Byturidae: Arnett (791), Böving & Craighead (39, 40, 75, pl. 45), Chu (111), Crowson (93), Peterson (16, 29, C3, C45), Van Emden (218, 256, f.28).

Callirhipidae: (see also Rhipiceridae); Crowson (57).

Calyptomeridae: Undescribed.

Camptosomatidae: (see also Chrysomelidae); Böving & Craighead (64, 79, pl. 107).

Cantharidae: Arnett (535), Böving & Craighead (11, 47, 48, pl. 77, pl. 78), Chu (97), Crowson (67), Peterson (11, 30, C1, C2, C56), Van Emden #57 (f.20).

Carabidae: Arnett (55), Böving & Craighead (17, 18, pl. 4), Chu (76), Crowson (5), Peterson (8, 31, C1, C2, C6, C8, C40), Van Emden #57 (210, 224, f.8), see also #2, 27, 45, 55, 72, 73, 86, 115, 117, 132, 133, 149.

Cassididae: (see also Chrysomelidae), Böving & Craighead (66, pl. 116).

Catopidae: (see Leptodiridae).

Cebrionidae: Arnett (494), Böving & Craighead (50, pl. 79), Chu (96), Crowson (61), Peterson (12).

Cephaloidae: Arnett (733), Böving & Craighead (41, 60, pl. 52), Chu (113), Crowson (119), Peterson (16, 18, 31, C.50).

Cerambycidae: Arnett (851), Böving & Craighead (66, pl. 99, pl. 100), Chu (51, 101), Crowson (139), Peterson (7, 32, C6, C14, C15, C16, C58), Van Emden #57 (211, 216, 264), see also #36, 46-50, 53, 75, 108, 142, 174.

Cerophytidae: Undescribed.

Cerylonidae: (see also Colydiidae), Crowson (96).

Chaetosomatidae: see #42.

Chelonariidae: Arnett (463), Böving & Craighead (45, pl. 71), Chu (93), Crowson (54).

Chrysomelidae: Arnett (899), Böving & Craighead (65, pl. 109), Chu (122-125), Crowson (141), Peterson (9-11, 13, 19, 33-36, C1, C3, C5-8, C32-38, C58), Van Emden #57 (211, 213, 215-217, 264, f.7, f.33, f.53), see also #95, 111, 118, 160, 163, 169.

Cicindelidae: Arnett (51), Böving & Craighead (9, 17, pl. 4), Chu (76), Crowson (5), Peterson (8, 37, C5, C41), Van Emden #57 (210, 224, f.36), Van Emden #58 (210, f. 1-6).

Cisidae: Arnett (827), Böving & Craighead (55, pl. 92), Chu (100), Crowson (93), Peterson (14, 15, 37, C5, C54), Van Emden #57 (217, 260, 262).

Clambidae: Arnett (440), no adequately illustrated description available.

Clavigeridae: (see also Pselaphidae) Undescribed.

Cleridae: Arnett (599), Böving & Craighead (56, 57, pl. 95), Chu (99), Crowson (82), Peterson (12, 38, C54), Van Emden #57 (214, 216, 253, f. 45) Van Emden #58 (215, f. 11-18).

Coccinellidae: Arnett (805), Böving & Craighead (38, 39, pl. 37), Chu (51, 109), Crowson (96), Peterson (14, 17, 38, C2, C5, C8, C38, C39), Van Emden #57 (216, 219, 254, f.35) see also #140.

Colydiidae: Arnett (839), Böving & Craighead (8, 40, 57, pl. 49), Chu (100, 111-112), Crowson (115) Peterson (13, 14, 16, C4, C50), Van Emden #57 (216, 218-220, 256, 258) see also #81.

CONONOTIDAE: Undescribed.

CORYLOPHIDAE: see Orthoperidae.

CRYPTOPHAGIDAE: Arnett (783), Böving & Craighead (34, pl. 29), Chu (104), Crowson (96), Peterson (16, 40, C4, C51), Van Emden #57 (218, 220, 256).

CUCUJIDAE: Arnett (775), Böving & Craighead (34, pl. 31), Chu (100, 104-106), Crowson (95), Peterson (12, 15, 17, 40, C1, C3, C7, C49), Van Emden #57 (217, 254, 256), see also #25, 81, 82.

CUPEDIDAE: Arnett (45), Böving & Craighead (6, 16, pl. 1), Chu (73), Crowson (4).

CURCULIONIDAE: Arnett (971), Böving & Craighead (67, pl. 120-122), Chu (51, 126-127), Crowson (158), Peterson (8, C2, C7-8, C18-25), Van Emden #57 (211, f.12, f.19, f.31-32), see also #104, 109, 110, 143, 163, 166, 169, 182.

CYBOCEPHALIDAE: (see also Nitidulidae), Böving & Craighead (37, pl. 37), Crowson (91, 99).

DASCILLIDAE: Arnett (441), Böving & Craighead (8, 44, pl. 63), Chu (89, 93, 96, 102), Crowson (51), Peterson (9), Van Emden #57 (214, 217, 226, f.13), Van Emden #58 (214), see also #18, 169.

DASYCERIDAE: Undescribed.

DERMESTIDAE: Arnett (561), Böving & Craighead (55, pl. 89-90), Chu (98, 111), Crowson (72), Peterson (14, 42, C3, C5, C45), Van Emden #57 (217, 226), see also #81, 122, 125, 155.

DERODONTIDAE: Arnett (555), Böving & Craighead (8, 33, pl. 27), Chu (102), Crowson (72), see also #64.

DISCOLOMIDAE: Crowson (98).

DONACIIDAE: (see also Chrysomelidae), Böving & Craighead (63, pl. 106).

DRILIDAE: Böving & Craighead (46, pl. 74-75, pl. 77), Crowson (65).

DRYOPIDAE: Arnett (471), Böving & Craighead (45-46, pl. 70-73), Chu (93), Crowson (55), Peterson (13, 42, C43), Van Emden #57 (213, 226, f. 4) see also #14, 16, 19, 169.

DYTISCIDAE: Arnett (191), Böving & Craighead (17, 23, pl. 6), Chu (77), Crowson (6), Peterson (8, 43, C2, C6, C8, C41-42), Van Emden #57 (224, f. 90) see also #13, 17, 20, 66, 169.

ELATERIDAE: Arnett (497), Böving & Craighead (50, 51, pl. 83-86), Chu (95), Crowson (61), Peterson (10, 12, 44, C5-7, C46-C47) Van Emden #57 (214, 254) see also #8, 37, 59, 99, 119-121, 131, 181.

ELMIDAE: Arnett (474), Crowson (55), Peterson (13, 42, C43), see also #12, 80, 169.

ENDOMYCHIDAE: Arnett (799), Böving & Craighead (8, 38, pl. 39-40), Chu (108), Crowson (98), Peterson (18, 45, C3, C53), Van Emden #57 (219, 220, 258).

EROTYLIDAE: Arnett (817), Böving & Craighead (39, pl. 41), Chu (103-104, 110), Crowson (96), Peterson (14, 46, C3, C7, C53), Van Emden #57 (216, 218, 258, 260, f. 49), see also #138.

EUCINETIDAE: Arnett (449), Böving & Craighead (33, 43, 73, pl. 26), Chu (102), Crowson (51), see also #169.

EUCNEMIDAE: Arnett (521), Böving & Craighead (13, 50, pl. 71), Chu (95), Crowson (62), Peterson (7, 73, C17), Van Emden #57 (211, 254), Van Emden #58 (218, f. 19, f. 23).

EUGLENIDAE: Arnett (754), Böving & Craighead (39, 60, 75), No adequate description available.

EURYPOGONIDAE: (see also Dascillidae) Böving & Craighead (8, 45, pl. 69), Chu (93), Crowson (54).

EURYSTETHIDAE: (see Salpingidae).

GALERUCIDAE: (see also Chrysomelidae) Böving & Craighead (65, pl. 110-114).

GEORYSSIDAE: Undescribed.

GEOTRUPIDAE: (see also Scarabaeidae), Böving & Craighead (52), Crowson (69).

GYRINIDAE: Arnett (207) Böving & Craighead (24, pl. 6), Chu (74), Crowson (6), Peterson (8, 46, C2, C6, C41), Van Emden #57 (210, 224, f. 14) see also #20, 141.

Haliplidae: Arnett (187), Böving & Craighead (17, 24, pl. 5), Chu (75), Crowson (6), Peterson (8, 47, C1, C6, C42), Van Emden #57 (210, 224, f. 17) see also #13, 20, 87.

Helodidae: Arnett (445), Böving & Craighead (44, pl. 65), Chu (90, 92), Crowson (51) Peterson (13, 15, 47, C4, C50), Van Emden #57 (217, 226), see also #169.

Helotidae: Undescribed.

Hemipeplidae: (see also Cucujidae), Böving & Craighead (35, pl. 31), Crowson (117).

Heteroceridae: Arnett (465), Böving & Craighead (7, 44, pl. 64), Chu (89), Crowson (54), Peterson (14-15, 48, C4, C43), Van Emden #57 (216, 226, f. 24, f. 42).

Hispidae: (see also Chrysomelidae) Böving & Craighead (66, pl. 115).

Histeridae: Arnett (369), Böving & Craighead (9, 11, 25, 31, pl. 20-21), Chu (117), Crowson (21), Peterson (12, 48, C2, C5, C7, C41), Van Emden #57 (212, 225), see also #81.

Homalisidae: Böving & Craighead (47), Crowson (65).

Hydraenidae: (see Limnebiidae).

Hydrochidae: Böving & Craighead (7, 32, pl. 22), Chu (118), Crowson (20).

Hydrophilidae: Arnett (215), Böving & Craighead (32, pl. 22-24), Chu (79, 117-118), Crowson (21), Peterson (7, 11-12, 15, 49, C6, C44), Van Emden #57 (210, 212, 213, 216, 225, f. 15, f. 38), see also #15, 19, 21, 116, 130, 156, 169.

Hydroscaphidae: Arnett (213), Böving & Craighead (25, 26, 31, pl. 9), Chu (79).

Hygrobiidae: Böving & Craighead (17, pl. 5), Chu (77), Crowson (6), Van Emden #57 (210, 224, f. 1), Van Emden #58 (213), see also #13, 169.

Hypocopridae: Undescribed.

Inopeplidae: (see also Cucujidae and Staphylinidae) Böving & Craighead (35), Crowson (117), see also #183.

Jacobsoniidae: (see Sarothridae).

Karumiidae: Undescribed.

Lagriidae: Arnett (697), Böving & Craighead (42, pl. 60), Chu (116), Crowson (115) Peterson (18, 50, C4, C52), Van Emden #57 (219, 262), Van Emden #58 (259), see also #78.

Lampyridae: Arnett (547), Böving & Craighead (11-13, 48, pl. 74-75), Chu (97), Crowson (67), Peterson (11, 50, C1-2, C8, C56), Van Emden #57 (f. 21, f. 43).

Languriidae: Arnett (795), Böving & Craighead (34, 40, 60, pl. 28), Chu (103), Crowson (96), Peterson (16, 51, C51) Van Emden #57 (219, f. 6).

Lathridiidae: Arnett (835), Böving & Craighead (8, 33, 38, 74, pl. 25), Chu (101-102), Crowson (98), Peterson (15, 51, C3, C53), Van Emden #57 (219, 220, 256, f. 27).

Leiodidae: Arnett (343), Böving & Craighead (7, 25, 26, 71, pl. 11), Chu (80), Crowson (29), see also #91, 124.

Lepiceridae: Undescribed.

Leptinidae: Arnett (339), Böving & Craighead (7, 25, 26, 43, pl. 10), Chu (80), Crowson (29), Peterson (15, 52, C4, C55), Van Emden #57 (213, 225, f. 3, f. 18, f. 34, f. 41), Van Emden #58 (213), see also #91, 180.

Leptodiridae: See #44, 124, 139, 161.

Limnebiidae: Arnett (227), Böving & Craighead (7, 25, 26, 31, pl. 8), Chu (79), Crowson (20), Peterson (49), see also #124, 139.

Limnichidae: Arnett (467), Crowson (55), no adequately illustrated description available.

Limulodidae: Arnett (353), Crowson (27), see also #124.

Lucanidae: Arnett (387), Böving & Craighead (8, 51, pl. 87), Chu (87), Crowson (43), Peterson (9, 52, C10, C31), Van Emden #57 (215), see also #52, 54, 61, 68, 77, 134.

Lycidae: Arnett (541), Böving & Craighead (48, pl. 76), Chu (98), Crowson (67), Peterson (11, 53, C56), Van Emden #57 (f. 22).

Lyctidae: Arnett (589), Böving & Craighead (63, pl. 102), Chu (120), Crowson (77), Peterson (10, 53, C3, C6, C30), Van Emden #57 (215, 264, f. 30), Van Emden #58, (265, f. 24-28), see also #106.

LYMEXYLIDAE: Arnett (617), Böving & Craighead (68, pl. 124), Chu (128), Crowson (86), Peterson (17, 54, C6-7, C17), Van Emden #57 (219-220, 262, f. 52), Van Emden #58 (259, f. 24, f. 29).

MALACHIIDAE: see Melyridae.

MELANDRYIDAE: (see also Tetratomidae), Arnett (723), Böving & Craighead (39, 60, 74, pl. 43) Chu (110), Crowson (119), Peterson (13-14, 16-18, 54, C1, C4, C10, C49, C58), Van Emden #57 (216, 258), see also #173.

MELASIDAE: See Eucnemidae.

MELOIDAE: Arnett (621), Böving & Craighead (58, 59, 60, pl. 96), Chu (85) Crowson (119), Peterson (6, 10, 56, C6, C57), Van Emden #57 (212, 214, 260), Van Emden #58 (219, f. 21-23), see also #101, 147, 148.

MELYRIDAE: Arnett (607), Böving & Craighead (8, 55, pl. 91-92), Chu (99), Crowson (82), Peterson (14, 57, C3, C54), Van Emden #57 (214, 253), see also #42, 63.

MENGEIDAE: Crowson (168).

MEROPHYSIIDAE: Crowson (98).

MERYCIDAE: Undescribed (see also Colydiidae).

MICROMALTHIDAE: Arnett (553), Böving & Craighead (6, 9, 16, pl. 2), Chu (45, 74), Crowson (4), Peterson (7, 57, C51).

MICROPEPLIDAE: Böving & Craighead (26, 31), Van Emden #57 (217, 225), see also # 91. No adequately illustrated description available.

MONOEDIDAE: (see also Colydiidae), Böving & Craighead (40, 75).

MONOMMIDAE: Arnett (707), Peterson (15, 58, C58).

MONOTOMIDAE: (see also Rhizophagidae) Böving & Craighead (33, pl. 25), Chu (103, 107), Van Emden #57 (218, 256).

MORDELLIDAE: Arnett (629), Böving & Craighead (39, 60, 74, pl. 98), Chu (118), Crowson (119), Peterson (8, 58, C6, C51), Van Emden #57 (212, 262).

MURMIDIIDAE: (see also Colydiidae) Böving & Craighead (38, pl. 27), Chu (108), Crowson (91), Peterson (15, 59, C53), Van Emden #57 (220, 258), see also #81.

MYCETOPHAGIDAE: Arnett (847), Böving & Craighead (40, pl. 50), Chu (112), Crowson (114), Peterson (16, 59, C4, C50), Van Emden #57 (219, 258, f. 25), see also #81.

MYCTERIDAE: Undescribed (see also Salpingidae).

MYLABRIDAE: See Bruchidae.

NEMONYCHIDAE: (see also Curculionidae), Crowson (156).

NILIONIDAE: Böving & Craighead (42, pl. 59), Chu (116), Crowson (115).

NITIDULIDAE: Arnett (757), Böving & Craighead (12, 36, pl. 35), Chu (107), Crowson (93), Peterson (14, 16, 17, 60, C3, C5, C7, C52), Van Emden #57 (217, 220), see also #30, 39.

NOSODENDRIDAE: Arnett (559), Böving & Craighead (43, pl. 66), Chu (90), Crowson (72), Peterson (13, 60, C52).

NOTERIDAE: Arnett (203), Böving & Craighead (17, pl. 5), Chu (77), Crowson (6), Peterson (8, 61, C42), Van Emden #57 (f. 35).

NOTIOPHYGIDAE: See #65.

OEDEMERIDAE: Arnett (737), Böving & Craighead (8, 40, 41, 60, pl. 51), Chu (112-113), Crowson (119), Peterson (18, 61, C4, C51), Van Emden #57 (220, 262), see also #135 (pupae only), 136.

OMOPHRONIDAE: (see also Carabidae), Böving & Craighead (17, 71, pl. 5), Chu (76).

ORTHOPERIDAE: Arnett (831), Böving & Craighead (26, 36, pl. 34), Chu (106), Crowson (98), Peterson (15, 17, 62, C50), Van Emden #57 (219, 254).

OSTOMIDAE: Arnett (593), Böving & Craighead (56, pl. 93-94), Chu (100), Peterson (15, 62, C1, C3, C6, C10,C54), see also #42.

OTHNIIDAE: Arnett (711), Böving & Craighead (42, 60, pl. 47), Chu (115), Peterson (17, 63, C50).

OXYCORYNIDAE: (see also Curculionidae), Crowson (156).

PASSALIDAE: Arnett (391), Böving & Craighead (11, 52, pl. 87) Chu (87), Crowson (43), Peterson (9, 64, C31), see also #134.

PASSANDRIDAE: (see also Cucujidae), Crowson (91).

PAUSSIDAE: Böving & Craighead (25, pl. 7), Chu (78), Crowson (5).

PEDILIDAE: Arnett (743), Böving & Craighead (41, 60, pl. 53), Chu (114), Crowson (135).
PELTIDAE: See #42.
PEROTHOPIDAE: Undescribed.
PETRIIDAE: Undescribed.
PHALACRIDAE: Arnett (823), Böving & Craighead (12, 14, 36, pl. 32-33), Chu (106), Crowson (96), Peterson (14, 16, 64, C51), Van Emden #57 (217, 254, f. 47).
PHENGODIDAE: Arnett (531), Böving & Craighead (48, pl. 74-75), Chu (98), Crowson (67), Peterson (11, 64, C56).
PHLOEOPHILIDAE: See #42.
PHYCOSECIDAE: See #42.
PLASTOCERIDAE: See Elateridae.
PLATYPODIDAE: Arnett (1029), Böving & Craighead (67, pl. 123), Chu (128), Crowson (164), Peterson (7, 65, C26), Van Emden #57 (211, 265, f. 5), Van Emden #58 (269).
PLATYPSYLLIDAE: Arnett (339), Böving & Craighead (25, 27, pl. 12), Chu (81), Crowson (29), see also #180.
PLATYSTOMIDAE: See Anthribidae.
PROPALTICIDAE: Undescribed.
PROTERHINIDAE: (see also Curculionidae), Böving & Craighead (66, pl. 119), Chu (125), Crowson (156).
PROTOCUCUJIDAE: Undescribed.
PSELAPHIDAE: Arnett (311), Böving & Craighead (11, 25, 30, 31, pl. 19), Chu (84), Crowson (31), Van Emden #57 (216, 226), see also #91, 124.
PSEPHENIDAE: Arnett (457), Böving & Craighead (45, pl. 70), Chu (92), Crowson (54), Peterson (13, 66, C43), see also #169.
PSOIDAE: (see also Bostrichidae) Böving & Craighead (62, pl. 102).
PTEROGENIIDAE: Undescribed.
PTILIIDAE: Arnett (349), Böving & Craighead (25, 26, 43, pl. 10), Chu (80), Crowson (28), Peterson (15), Van Emden #57 (213, 217, 225, f. 40), see also #91, 124.
PTILODACTYLIDAE: Arnett (460), Böving & Craighead (8, 44, 45, pl. 67-69), Chu (92), Crowson (54), Peterson (12, 14, 66, C30), see also #157.
PTINIDAE: Arnett (577), Böving & Craighead (62, pl. 101), Chu (119), Crowson (77), Peterson (10, 15, 67, C2, C30), Van Emden #57 (215, 264, f. 9, f. 14), see also #74, 81, 82.
PYROCHROIDAE: Arnett (719), Böving & Craighead (41, 60, pl. 53) Chu (114), Crowson (118), Peterson (17, 67, C1, C4, C49), Van Emden #57 (219, 262), Van Emden #58 (261, f. 31, f. 34-36), see also #158.
PYTHIDAE: (see also Salpingidae) Böving & Craighead (41, 42, 60, pl. 54), Chu (114-115), Crowson (118), Peterson (16-18, 68, C52) Van Emden #57 (219, 262).
RHIPICERIDAE: Arnett (491), Böving & Craighead (13, 49, 50, pl. 79, pl. 82), Chu (93, 96), Crowson (57), Peterson (11, 68, C2, C51).
RHIPIPHORIDAE: Arnett (633), Böving & Craighead (59-60, pl. 97), Chu (86), Crowson (119), Peterson (10), Van Emden #57 (212, 214, 260), Van Emden #58 (223).
RHIZOPHAGIDAE: Arnett (767), Böving & Craighead (33, pl. 28), Chu (103), Crowson (93), Van Emden #57 (218, 256, f. 46.).
RHYSODIDAE: Arnett (49), Böving & Craighead (16, pl. 3), Chu (75), Crowson (5), Peterson (8).
SAGRIDAE: (see also Chrysomelidae), Böving & Craighead (63, pl. 104).
SALPINGIDAE: Arnett (713), Böving & Craighead (40-41, 60, pl. 48, pl. 54), Chu (111), Crowson (117).
SANDALIDAE: see Rhipiceridae.
SAROTHRIIDAE: Undescribed.
SCAPHIDIIDAE: Arnett (363), Böving & Craighead (25, 27, pl. 12), Chu (82), Crowson (31), Peterson (12, 14, 69, C55), Van Emden #57 (213, 225, f. 39), see also #91, 124.
SCARABAEIDAE: Arnett (395), Böving & Craighead (52-55, pl. 87-88), Chu (88-89), Crowson (43), Peterson (9, 69, C4-7, C9-12, C31), Van Emden #57 (215), see also #5, 40, 54, 61, 70, 84, 85, 88-90, 112, 113, 123, 134, 144, 175.

Scolytidae: Arnett (1031), Böving & Craighead (67, pl. 123), Chu (126), Crowson (164), Peterson (7, 70, C26-27), Van Emden #57 (211, 264), also see #76, 164, 165, 167.

Scraptiidae: (See also Melandryidae), Böving & Craighead (39, pl. 44), Chu (110), Crowson (119), Van Emden #57 (220, 260, f. 2, f. 29).

Scydmaenidae: Arnett (357), Böving & Craighead (11, 25, 30-31, pl. 16, pl. 19), Crowson (31), Peterson (13), Van Emden #57 (216, 226), see also #91, 124.

Serropalpidae: See Melandryidae.

Silphidae: Arnett (329), Böving & Craighead (25, 27, pl. 13), Chu (80, 82), Crowson (32), Peterson (12, 15, C2, C10, C55), Van Emden #57 (213, 225), see also #44, 91, 124.

Silvanidae: (see also Cucujidae), Arnett (775), Böving & Craighead (8, 34, pl. 30), Chu (104), Crowson (95), Van Emden #57 (220).

Smicripidae: (see also Rhizophagidae), Böving & Craighead (12, 33, 36, pl. 32), Chu (107), Crowson (93), no adequately illustrated description available.

Spercheidae: (see also Hydrophilidae), Böving & Craighead (32, pl. 21) Chu (117, 118), Crowson (20), Van Emden #57 (216).

Sphaeriidae: see #31.

Sphaeritidae: Undescribed.

Sphindidae: Arnett (771), Böving & Craighead (34, 37-38, pl. 41), Chu (107), Crowson (95), Peterson (18), Van Emden #57 (220, 258), Van Emden #58 (219, f. 20).

Staphylinidae: Arnett (233), Böving & Craighead (11, 25, 27-30, pl. 14-18), Chu (51, 81, 83), Crowson (31), Peterson (8, 12, 71, C5, C55), Van Emden #57 (212, 213, 216, 226), see also #11, 67, 81, 91, 124, 128, 129, 169 176.

Stylopidae: Arnett (639), Crowson (168), Van Emden #57 (211, 213, 215, 260).

Synchroidae: (see also Melandryidae), Böving & Craighead (8, 39, 41, pl. 52), Chu (113), Van Emden #57 (219, 262), Van Emden #58 (261, f. 30).

Synteliidae: Crowson (21), no adequately illustrated description available.

Telegeusidae: Undescribed.

Telephoridae: (=Lampyridae, Lycidae & Drilidae) Van Emden #57 (212, 214, 253, f. 20-21, f. 43).

Tenebrionidae: Arnett (645), Böving & Craighead (56, pl. 93-94), Chu (113, 115-116), Crowson (115), Peterson (16, 18, 72, C1, C4, C6, C10, C48), Van Emden #57 (219-220, 262), see also #33, 34, 43, 60, 79, 81, 83, 92-94, 103, 128, 132-136, 145, 150-153.

Tetratomidae: (see also Melandryidae) Crowson (119).

Thorictidae: (see also Dermestidae) Crowson (72).

Throscidae: Arnett (513), Böving & Craighead (13, 50, 51, pl. 81), Chu (95), Crowson (62), Peterson (7, 73, C17), Van Emden #57 (214, 254).

Torridincolidae: see #159.

Trachypachidae: (see also Carabidae), Crowson (5), see also #98.

Trichopterygidae: see Ptiliidae.

Trictenotomidae: No adequately illustrated description available.

Trixagidae: See Throscidae.

Trogidae: (see also Scarabaeidae), Böving & Craighead (8, 52, pl. 87), Chu (88) Crowson (43), Peterson (9, 73), see also #5.

Trogositidae: (see also Ostomidae), Crowson (82), Van Emden #57 (214, 253), Van Emden #58 (214, f. 7-10).

Zopheridae: (see also Tenebrionidae), Böving & Craighead (41, pl. 52).

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LITERATURE NOTICES

MALCOLM, STANLEY E. 1971. *The water beetles of Maine*: including the families Gyrinidae, Haliplidae, Dytiscidae, Noteridae, and Hydrophilidae. University of Maine Tech. Bull. 48:1-49; 11 fig.

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Entomologische Arbeiten aus dem Museum G. Frey. Vol. 22 for 1971 (edited by G. Scherer). 249p. [Contains 14 articles, mostly dealing with Coleoptera in the Frey museum. Volumes may be obtained on exchange by writing: Museum G. Frey, 8132 Tutzing bei München, Bundesrepublik Deutschland (West Germany)].

PAPP, C. S. AND R. A. BROWN. 1970. *The magic of color printing;* for art classes, printers, and laymen who deal in printing. American Visual Aid Books. 119p.; 91 progressive prints in color. $7.50. [A useful little book for anyone contemplating color printing; noted here because it was authored by one of our members, from whom it may be ordered: Charles S. Papp, 7451 Albezzia Ln., Sacramento, CA 95828].

J. LINSLEY GRESSITT. 1970. Biogeography of Laos. Pacific Insects Monograph. 24:573-626. [This is a part of the volume on Cerambycidae of Laos by Gressitt, Rondon, and Breuning. It is especially useful for general information desired by a taxonomist studying this part of the World].

Eastern Forest Insects by Whiteford L. Baker. 1972. USDA Forest Service Misc. Publ. 1175:1-642; 207 fig. [This is essentially a revised edition of F. C. Craighead's "Insect enemies of eastern forests", USDA Misc. Publ. 657, published in 1950. The importance of Coleoptera is exemplified by its coverage (p. 113-273). Copies may be obtained for $5.00 from the Superintendent of Documents, U. S. Government Printing Office, Washington, DC 20402 or by writing your congressman].

—R. E. Woodruff

OBSERVATIONS ON THE BIOLOGY OF *PARACOTALPA PUNCTICOLLIS* LECONTE (COLEOPTERA: SCARABAEIDAE: RUTELINAE)

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Abstract

Observations on the behavior, host plants, and predators of *Paracotalpa puncticollis* LeC. are recorded. The distribution and phenology of all known specimens are plotted.

Introduction

Specimens of *Paracotalpa puncticollis* LeConte (1863:78), one of the most striking beetles found in the southwestern U.S. are comparatively rare in collections. A survey of museum and private collections revealed a total of 808 specimens (68% from private collections), approximately 25% females and 75% males. Sixty percent of the reported specimens were taken at one locality, Seven Level Hill in Riverside County, California. The paucity of specimens in collections is probably the result of inadequate collecting, resulting from the meager knowledge of the species' biology.

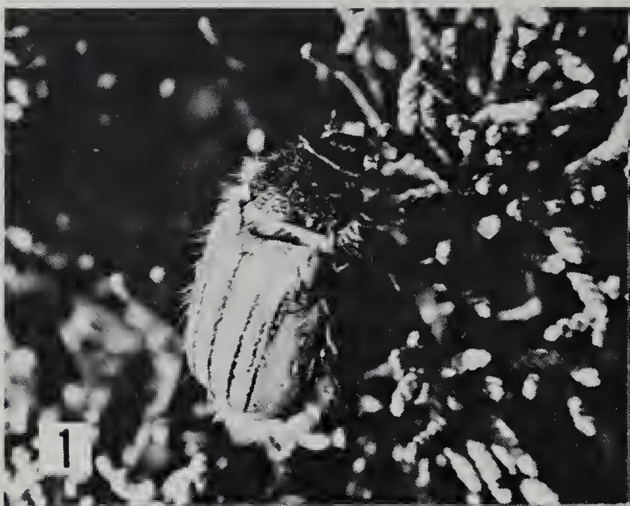
Papers by LeConte (1863), Wickham (1905), Ohaus (1915), Saylor (1940), and Hardy (1971) deal primarily with classification of *Paracotalpa* and related genera, and give little ecological information. The following is an attempt to add to the knowledge of the biology of this species.

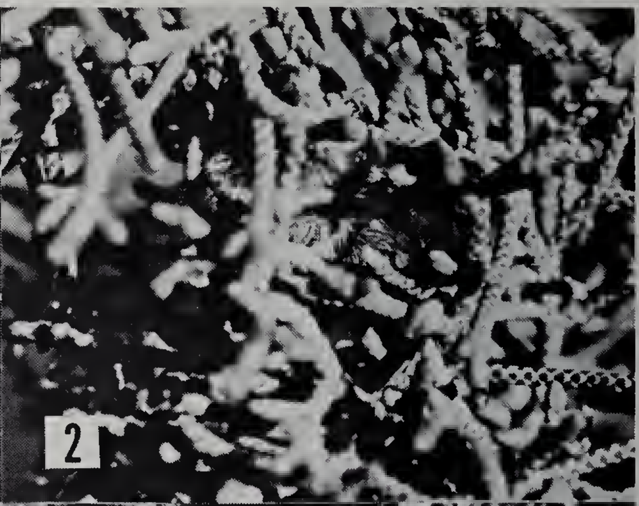
Habitat and Host Plant

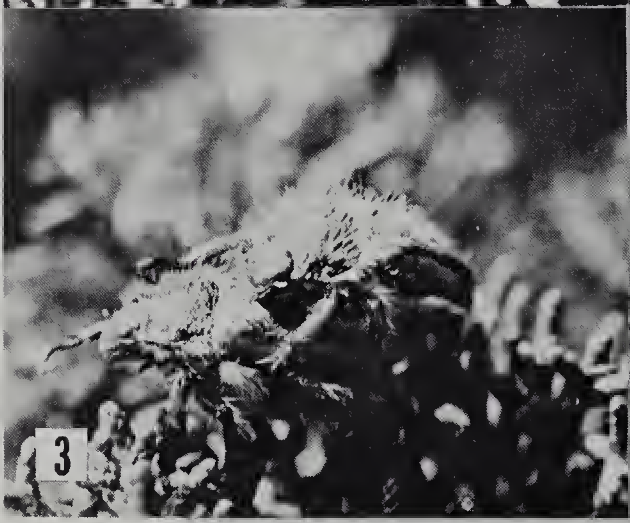
Paracotalpa puncticollis is usually found in pinyon-juniper areas, and appears to be associated with plants of the genus *Juniperus* (Fig. 7). Observations of adults emerging from litter at the base of juniper may indicate that larvae feed on roots of this plant. Adults have been observed feeding on needles of juniper, and analysis of fecal material has confirmed this adult diet. Attempts to find larvae on roots of *Juniperus* were unsuccessful, and no information is available on the larvae. Attempts to induce oviposition in the laboratory were also unsuccessful, undoubtedly the result of failure to duplicate field conditions.

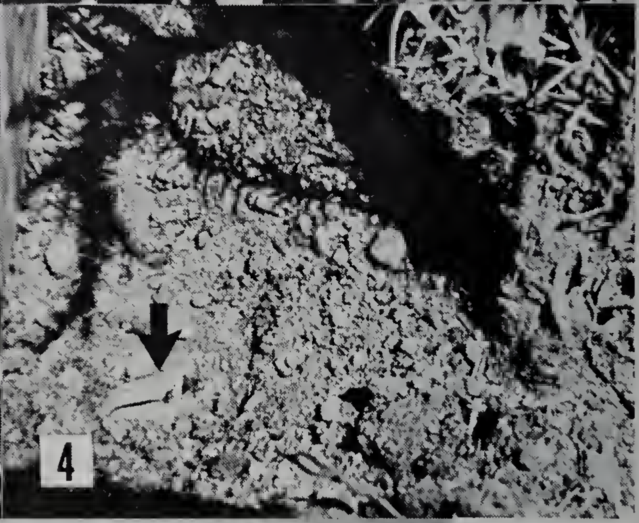
In California, this species is associated with *Juniperus californica* Carr., although in the eastern portions of the range, additional species (perhaps *J. monosperma* (Engelm.), *J. osteosperma* (Torr.) or *J. deppeana* Steud) are probably suitable hosts. In southern California, juniper is often found in areas receiving relatively little precipitation, often in the form of snow. Summers in these areas are hot and dry, and the trees are often exposed to severe wind action. Figure 5 shows a *Juniperus californica* in a typical habitat (Seven Level Hill, Riverside Co., California).

Robert Duff (1970 in litt.) has collected *P. puncticollis* on cheesebush (*Hymenoclea salsola* T. & G., Asteraceae), where he has observed these beetles in copulation, but has observed no feeding. These plants are evidently a convenient landing spot for individuals moving down canyon. Duff also reports most collected or observed specimens landed in the same general area, and after mating flew back up the canyon toward higher elevations.









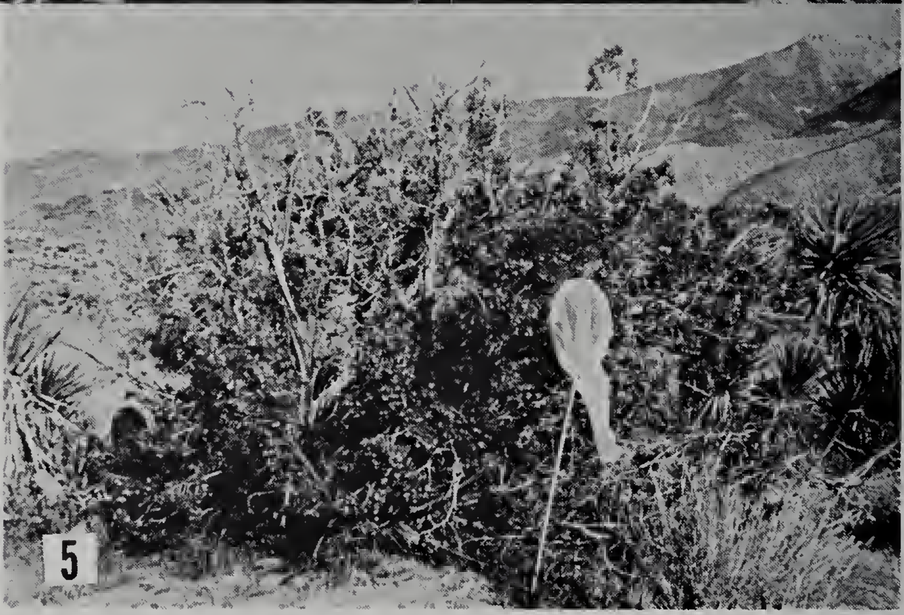


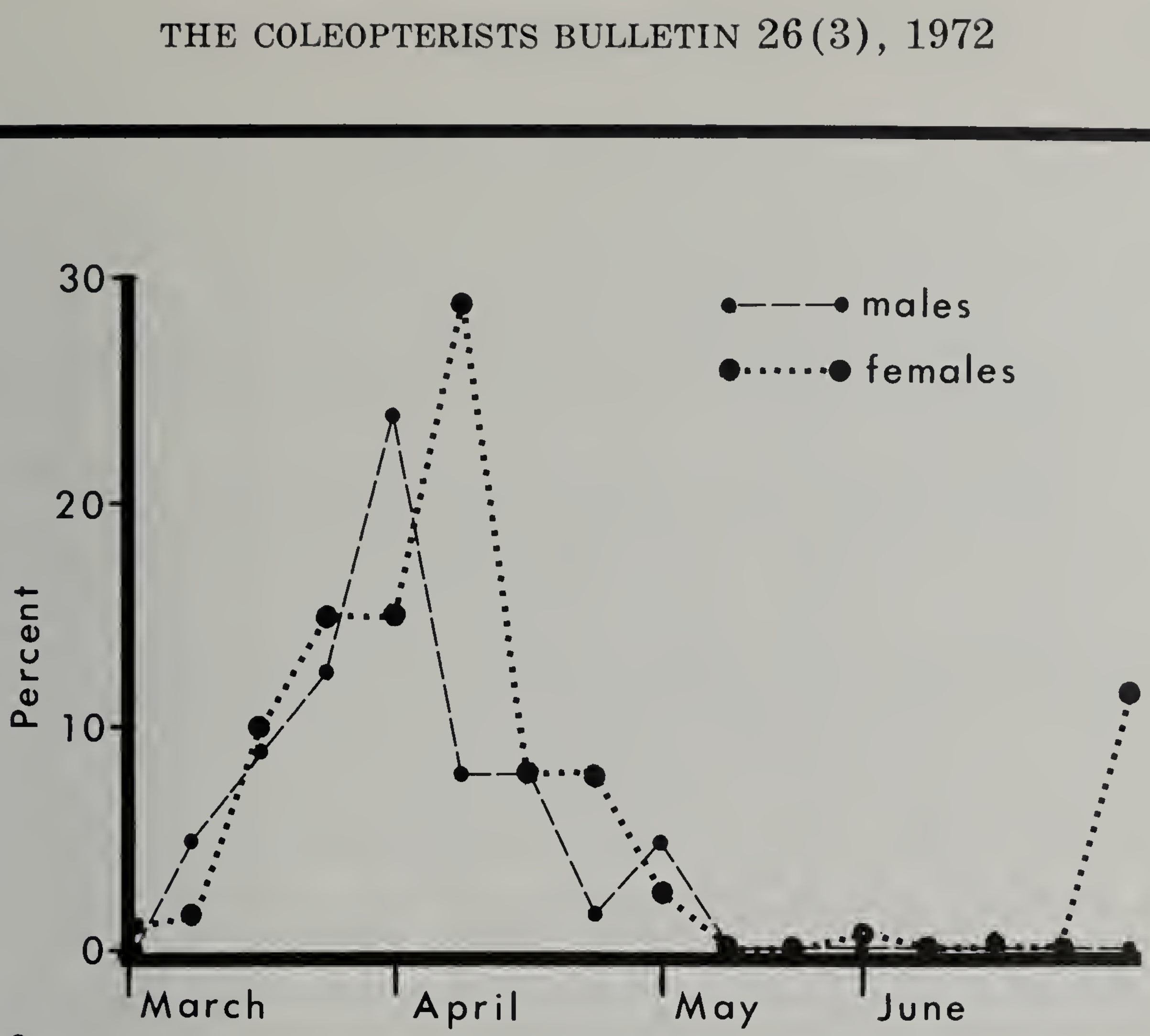
Figure 1. *Paracotalpa puncticollis* after flight to apical leaves from soil.

Figure 2. *P. puncticollis* hidden in apical foliage of *Juniperus californica.*

Figure 3. Mating pair of *P. puncticollis.* Note darker clypeus of female (see text).

Figure 4. *P. puncticollis* in soil at base of juniper plant.

Figure 5. *Juniperus californica* at locale known as Seven Level Hill. Note poor condition of plant, dead limbs, and sparse foliage. Plant is one which has been an apparent favorite, many specimens collected from the foliage.



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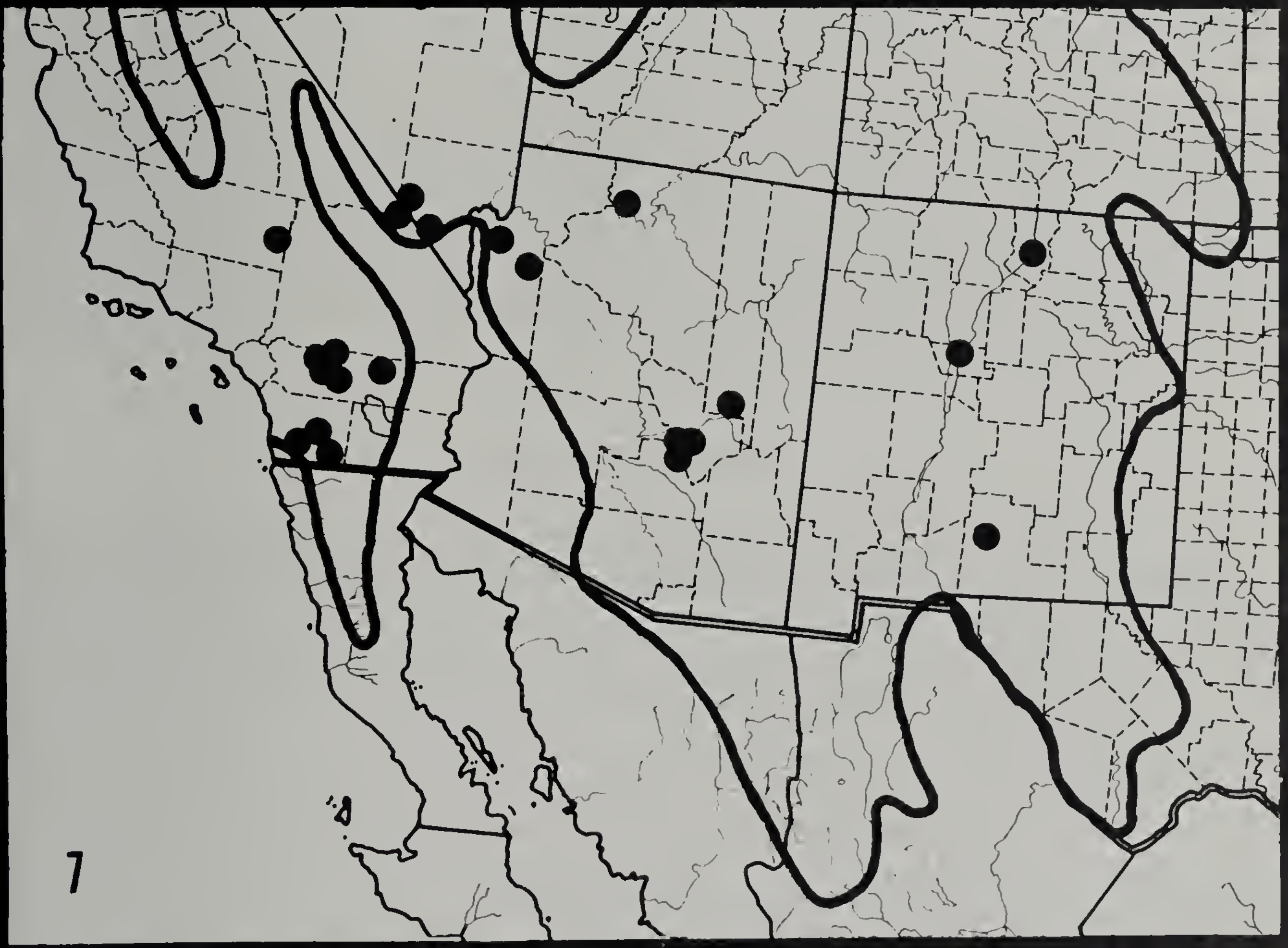

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Figure 6. Seasonal activity of *P. puncticollis*. Percent is of the total of each sex. Plotted at weekly intervals, from March 1.

Figure 7. Known distribution of *P. puncticollis*. Heavy line represents the greatest distribution of plants of the genus *Juniperus* (see text).

EMERGENCE AND BEHAVIOR

Earliest recorded adult occurrence is that of a single male specimen labelled "February" (Base of Pinal Mtns., Arizona). Latest activity noted was June 17 (Taos, New Mexico, 26 specimens). The northern location of Taos probably results in a later onset of appropriate conditions for adult activity (Humboldt's law). Evidently males emerge slightly earlier than females (Fig. 6).

In California, daily onset of adult activity appears to be approximately 3 pm. Adults emerge from holes in the loose, decomposed granite soil at the bases of juniper and fly to the foliage, apparently preferring the sunlit side of the plant (Fig. 1). Many individuals move into the apical foliage, where coloration of the prothorax and elytra provides nearly complete concealment (Fig. 2). [An apparently previously unrecorded dimorphism is present in *Paracotalpa puncticollis*: In females the apex of the clypeus is a brick red color, while the vertex is metallic green; in males the head is uniformly green.] Males later seek out females, and mating takes place on the outer foliage (Fig. 3). There is no elaborate premating behavior. After copulation, females generally move down the stalks and burrow into the soil at the base of the host plant, where presumably oviposition takes place (Fig. 4).

Observation indicates that this species will swarm at dusk. Ed Giesbert (1969 in litt.) observed adults emerging from litter at the bases of junipers and flying to other trees. After dark, females with several males were found, and, in a single clump, 6 males and a single female were observed gripped tightly together. Frank Hovore (1969 in litt.) found a similar cluster of 8 males. Hovore also noted that, on 1 April 1969, this swarming activity was from 6:13 pm to about 6:35 pm. The authors have also observed this behavior at dusk and the abrupt cessation at darkness. Blacklight traps operated at dusk have generally proved ineffective, and the 1 or 2 specimens collected in this fashion appear to have resulted more from accident than from habit. Decrease in temperature and increase in wind appear to depress normal flight activity.

NATURAL ENEMIES

Hovore (1969 in litt.) observed ground squirrels digging these beetles from litter beneath juniper. He also noted a number of scratch marks under juniper trees which may have been produced by squirrels searching for food. Birds commonly observed in the area of Seven Level Hill are the scrub jay, loggerhead shrike, California thrasher, cactus wren, and western mockingbird. Examination of the nests of scrub jays and mocking birds has revealed numerous elytra and body parts of *P. puncticollis*. Other species of birds have not been directly proved as feeding upon *P. puncticollis*, although there is evidence of shrike feeding activity for *Paracotalpa deserta* Saylor (Hardy, 1972).

DISTRIBUTION

Since *Paracotalpa puncticollis* appears to be so directly associated with *Juniperus*, the distribution of the species has been plotted (Fig. 7) with the greatest range of juniper (compiled from Preston 1961). Specific localities for the collection of *P. puncticollis* are as follows:

CALIFORNIA: *Riverside Co.*: Joshua Tree National Monument, Cottonwood Springs; San Jacinto Mountains; Santa Rosa Mountains, Seven Level Hill (Palms to Pines Highway, California 74, 10 mi. NW Palm Desert); Whitewater Cyn., 3 to 5 mi. N Whitewater. *San Bernardino Co.*: Joshua Tree National Monument, Covington Flats; Keystone Mtns.; Mojave Desert, near Keys Ranch; Horse Thief Springs; El Paso Mountains, near Randsburg; Granite Mountains, Snake Springs. *San Diego Co.*: San Felipe Valley, 1 mi. N Scissors Crossing; 5 mi. E Jacumba; Jacumba Hot Springs; Otay Mountains, near Summit.

NEVADA: *Clark Co.*: Kyle Ranch, Charleston Mountains; Willow Springs, Spring Mountains.

ARIZONA: White Mountains (White Hills, Mohave Co.?) *Coconino Co.*: Grand Canyon. *Gila Co.*: Claypool; Globe; Base of Pinal Mountains; Sierra Ancha Mountains; Six Shooter Canyon, Pinal Mountains. *Mohave Co.*: Vicinity of Peach Springs, 15 mi. W Yavapai Co. line. *Navajo Co.*: Carrizo. *Pima Co.*: Tucson (doubtful data).

NEW MEXICO: *Bernalillo Co.*: Albuquerque. *Otero Co.*: Alamogordo, 4400 to 5000 ft. *Taos Co.*: Taos.

It would seem likely, from the above records, that there are many areas where this species could be encountered. Areas of juniper in northern Baja California could be expected to yield this species, as would areas in Arizona, New Mexico, and possibly Utah, Colorado, Texas, and Mexico (northern Chihuahua and Sonora).

ACKNOWLEDGEMENTS

We would like to thank the many people who responded to the questionnaire mailed at the outset of this investigation. Approximately 40 replies were received, too many for individual acknowledgement. Especial thanks are due Robert Duff, Downey, California, and Ed Giesbert and Frank Hovore of Los Angeles, California, for the important records and observations here recorded.

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ECOLOGICAL NOTES ON *CRYPTOGLOSSA BICOSTATA* SOLIER (COLEOPTERA:TENEBRIONIDAE)

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Abstract

The second known specimen of *C. bicostata* Solier is recorded from Yagul, Oaxaca, Mexico, at an elevation of 5,500 ft., on July 7, 1970.

In 1964, the senior author published a synopsis of the genus *Cryptoglossa* Solier. At that time, *C. bicostata* Solier (1836), the type species of the genus, was known only from the type specimen which lacked antennae and had no more specific locality data than "du Mexique." The terminal 2 antennal segments are necessary in distinguishing between *Cryptoglossa* and the very similar genus *Centrioptera* Mannerheim. It is possible that the 2 genera will ultimately prove synonymous so that the status of *C. bicostata* is obviously very important, especially since *Cryptoglossa* is the older name.

Recently the junior author sent to the senior author what is apparently the second specimen of *C. bicostata* known to science. It is in good condition except that all but the left anterior tarsal segments are broken off and, ironically, the antennae have the important terminal segments missing. It is a little larger and more slender (28mm long; 10mm wide) than the Solier type (27mm long; 11mm wide). Although the specimen cannot clarify the status of generic relationships, it is accompanied by detailed ecological data which may enable someone collecting in the area to obtain more specimens.

Label data on the specimen are as follows: Yagul, Hwy 190, 15 mi. so. Oaxaca, Oax., Mexico, 7-VII-1970, David E. Bixler.

The Yagul ruins site is at an elevation of 5500 feet and is dominated by semi-arid shrubs including various oaks, mesquite, acacias, *Opuntia*, and columnar cacti of the ribbed *Cereus* group. The soil is poorly developed, compact, and rocky. The area was relatively undisturbed until 1959 when the ruins were discovered, although most of the surrounding area has had a long history of agriculture. The specimen was collected by sweeping semi-arid scrub vegetation along the parking area at the ruins. The specimen is deposited in the Ohio State University Collection of Insects and Spiders.

A can-trapping (pitfall) operation in the Yagul area might yield interesting results since this collecting technique has captured enormous numbers of *Centrioptera* and other ground-dwelling tenebrionids in Arizona, California, Texas and elsewhere. Many of these have been considered about as rare as *C. bicostata*.

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ON THE MESOSTERNUM IN SOME NITIDULIDAE (COLEOPTERA), WITH A KEY TO THE NEW WORLD *AMPHICROSSUS*

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ABSTRACT

The external development of the mesosternum and prosternal process is described and figured, providing useful characters for defining genera. An additional character, an area of the metasternum known as the axillary space, is also discussed and figured. As a result, *Psilopyga* Lec. is separated from *Oxycnemus* Er. and reinstated. Also *Epuraea liebecki* Pars. is redescribed and transferred to *Amphicrossus*. A key is presented for New World *Amphicrossus*.

In the course of defining certain genera in the nitidulid subfamily Nitidulinae it became evident that the external development of the mesosternum offers useful diagnostic characters which require much more explicit description than they have received.

Among nitidulid genera, in the normal position of repose, the prosternal process covers the mesosternum in varying degree, as shown in the figures. In certain genera the prosternal process is compressed apically and variably concave dorsally. Also in these genera the mesosternum is slightly (if at all) elevated. This condition is observed in *Omosita, Nitidula, Lobiopa, Soronia, Ipidia, Amphotis, Trimenus, Camptodes, Aethina, Psilopyga, Phenolia, Physosoronia, Epuraea, Stelidota, Haptoncus, and Aphenolia.* Among other genera the apex of the prosternal process is bluntly convex, and it varies dorsally from not concave to strongly concave, as in *Thalycra, Pocadius, Orthopeplus, Lasiodactylus, Cychramus, Pallodes, Pocadites, Pocadiodes, Atarphia, Teichostethus, Xenostrongylus, Cyllodes,* and *Oxycnemus. Amphicrossus* exhibits an intermediate condition.

An overlooked character is the development of the axillary space at the antero-lateral angle of the metasternum. This space is formed by a caudal marginal line of the mesocoxal cavity which is parallel to the cavity but diverges in varying degree as it approaches the metepisternum. Although the axillary space is absent in a few genera, such as *Epuraea, Pallodes, Trimenus,* and *Xenostrongylus,* it is usually present and affords a useful character for defining species. It is discussed below under the various genera.

In the course of this study *Oxycnemus* is shown to be composed of 2 distinct groups of species. For 1 group *Psilopyga* Lec. is reinstated. Also the species *Epuraea liebecki* Parsons is transferred to *Amphicrossus*.

I. MESOSTERNUM ALONG MEDIAN LINE ON SAME PLANE AS METASTERNUM:

Omosita (Fig. 1,2): In the genotype *colon* (L.) the longitudinal carina is usually well developed and easily seen. In *funesta* Reit. the carina is very fine. In *discoidea* (F.) the carina is obsolete and very short at anterior margin. In *depressa* (L.) no carina is evident. The axillary space (Fig. 84) is present in the above species.

Nitidula (Fig. 3,4): Not carinate in the genotype *rufipes* (L.), *bipunctata* (L.), *carnaria* (Schall.), *flavomaculata* Rossi, *ziczac* Say and with a short obsolete carina in *fusula* Gebl. A small axillary space (Fig. 85) is present in the above species.

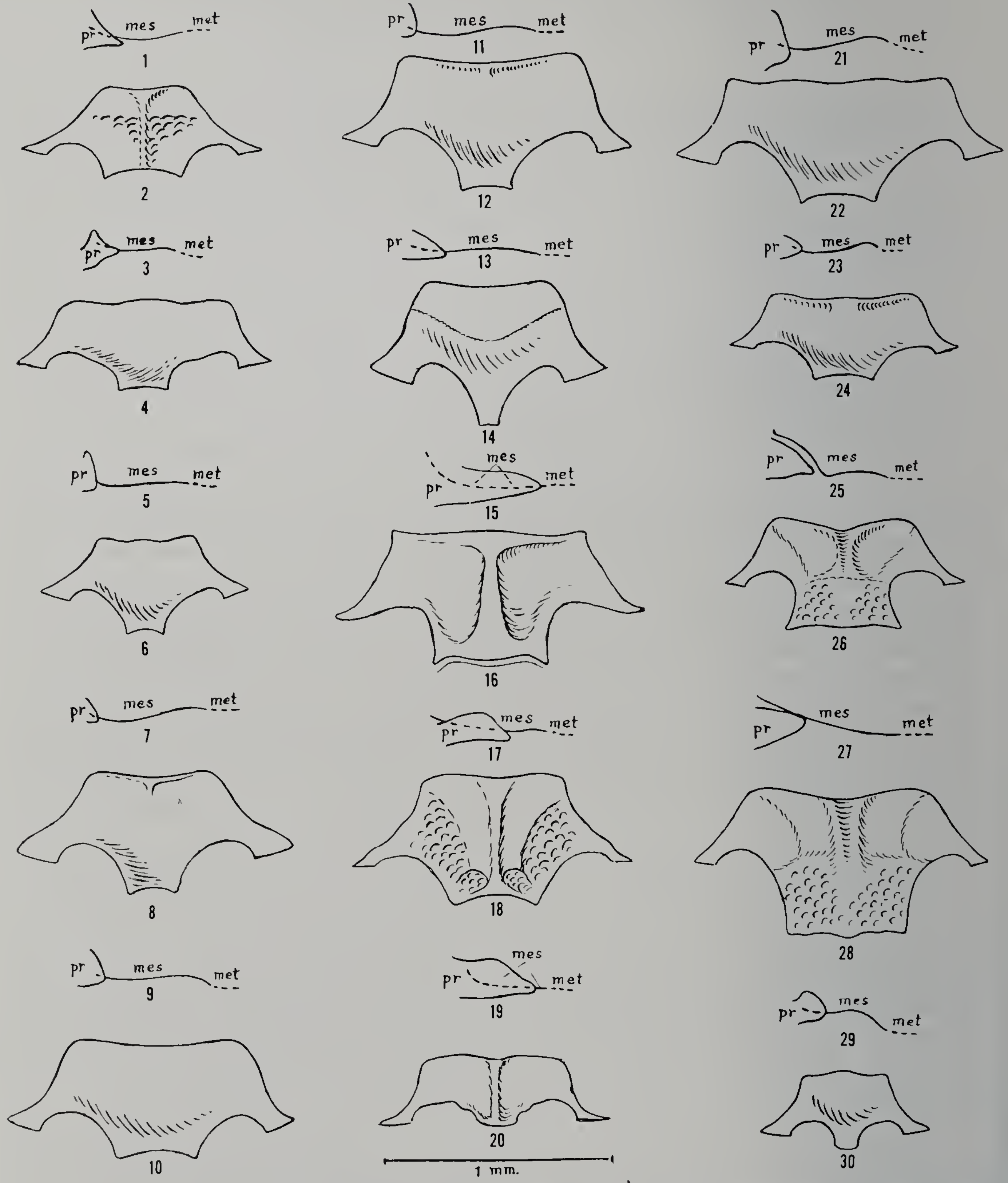

Fig. 1-30: Mesosternum in certain Nitidulidae. Odd numbers show the mesosternum in profile from the left side. Even numbers show ventral views of the mesosternum. Abbreviations as follows: mes—mesosternum, met—anterior part of the metasternum, pr—apical part of prosternal process. 1,2) *Omosita colon.* 3,4) *Nitidula bipunctata.* 5,6) *Lobiopa undulata.* 7,8) *Soronia guttulata.* 9,10) *Ipidia variolosa.* 11,12) *Amphotis ulkei.* 13,14) *Trimenus adpressus.* 15,16) *Camptodes texanus.* 17,18) *Aethina aeneipennis.* 19,20) *Psilopyga nigripennis.* 21,22) *Phenolia grossa.* 23,24) *Physosoronia explanata.* 25,26) *Amphicrossus ciliatus.* 27,28) *Amphicrossus liebecki.* 29,30) *Epuraea avara.*

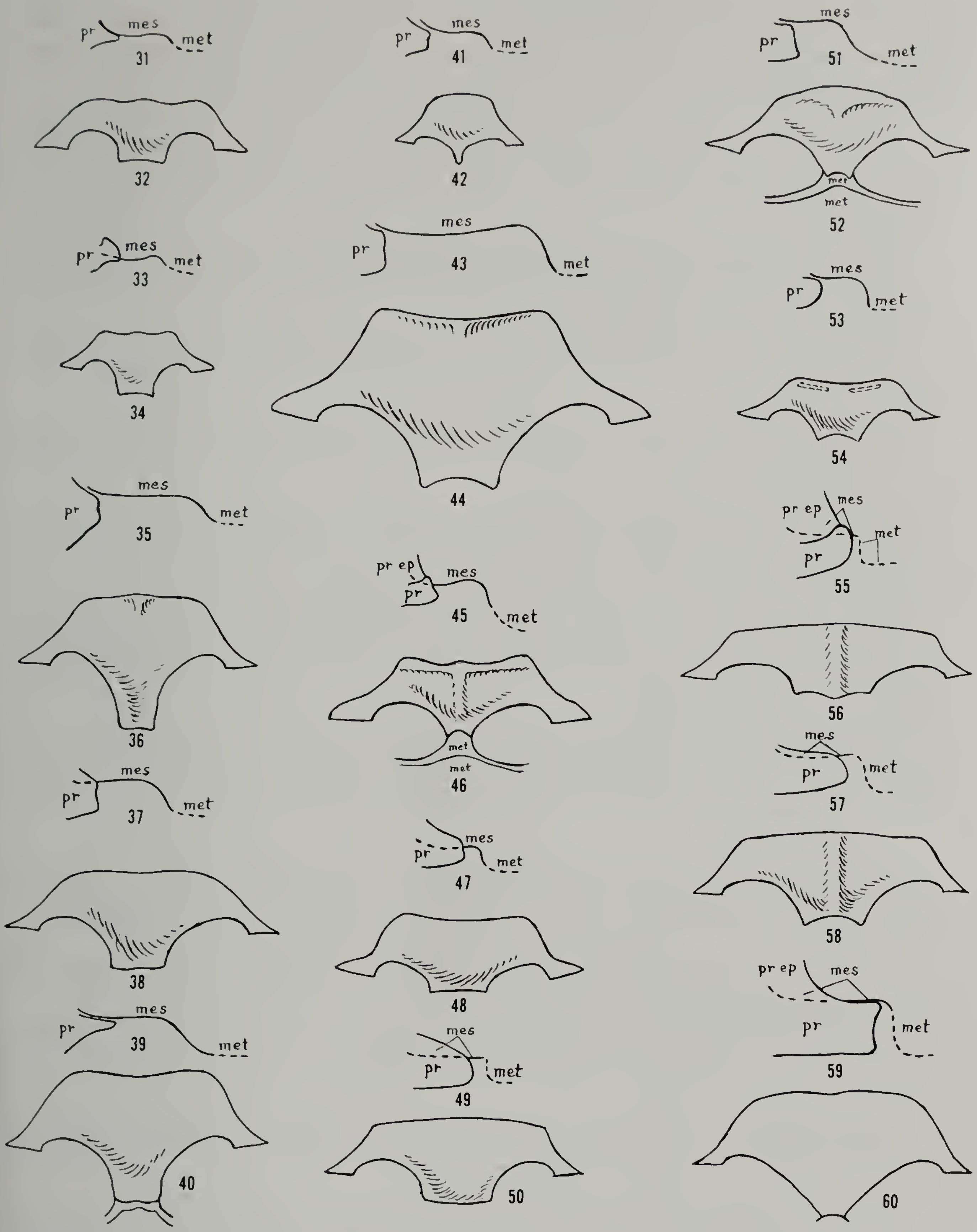

Fig. 31-60: Mesosternum in certain Nitidulidae. Odd numbers show the mesosternum in profile from the left side. Even numbers show ventral views of the mesosternum. Abbreviations as follows: mes—mesosternum, met—anterior part of the metasternum, pr—apical part of prosternal process, pr ep—prosternal episternum. 31,32) *Stelidota geminata.* 33,34) *Haptoncus luteolus.* 35,36) *Thalycra parsonsi.* 37,38) *Pocadius helvolus.* 39,40) *Aphenolia monogama.* 41,42) *Orthopeplus guadricollis.* 43,44) *Lasiodactylus pictus.* 45,46) *Pallodes pallidus.* 47,48) *Pocadites dilatimanus.* 49,50) *Pocadiodes vajdelota.* 51,52 *Cychramus adustus.* 53,54) *Xenostrongylus arcuatus.* 55,56) *Cyllodes ater.* 57,58) *Teichostethus guatemalenus.* 59,60) *Oxycnemus fulvus.*

Lobiopa (Fig. 5,6): Not carinate in *undulata* (Say), *falli* Pars., *setosa* Har., *brunnescens* Blatch., and *insularis* (Cast.) except that in some *setosa* and *insularis* there may be a short obsolete carina at the anterior margin. A small axillary space (Fig. 86) is present in the above species.

Soronia (Fig. 7,8): A very short obsolete carina may be absent or present at the anterior margin in the genotype *punctatissima* (Ill.), *guttulata* (Lec.), *grisea* (L.), *oblonga* Bris. The axillary space (Fig. 87) is very small or absent.

Ipidia (Fig. 9,10): Not carinate in the genotype *quadrimaculata* (Quensel), *sibirica* (Reit.), and *variolosa* Reit. There is a large axillary space (Fig. 88) in the above species.

Amphotis (Fig. 11,12): Not carinate in the genotype *marginata* (Fabr.) and *ulkei* Lec. There is a very small axillary space (Fig. 89) in the above species.

Trimenus (Fig. 13,14): Not carinate and no axillary space (Fig. 90) in *adpressus* Murr.

Camptodes (Fig. 15,16): There is a well developed carina which becomes broader posteriorly in *texanus* Schaef., *nigerrimus* Pars., and *gaumeri* Sharp. In the above 3 species the anterior fifth of the mesosternum is sharply elevated and an axillary space (Fig. 91) is present.

Aethina (Fig. 17,18): The carina is well developed in *aeneipennis* Reit. The axillary space (Fig. 92) is very large extending to the postero-lateral angle of the metasternum.

Psilopyga (Fig. 19,20): There is a well developed carina in the genotype *histrina* Lec., *nigripennis* Lec., *fasciata* Sharp, *latus* (Sporn.), and *lewisi* (Reit). The axillary space is well developed in the above species (Fig. 61-65, 93).

II. MESOSTERNUM ALONG MEDIAN LINE ON NEARLY THE SAME PLANE AS METASTERNIUM EXCEPT THAT THE POSTERIOR FOURTH IS FEEBLY ELEVATED:

Phenolia (Fig. 21,22): Not carinate and a small axillary space (Fig. 94) in the genotype *grossa* (Fabr.).

Physosoronia (Fig. 23, 24): Not carinate and a small distinct axillary space (Fig. 95) in the genotype *explanata* Reit.

III. MESOSTERNUM ON MEDIAN LINE HORIZONTAL ALONG POSTERIOR HALF AND OBLIQUELY ELEVATED ALONG ANTERIOR HALF:

Amphicrossus (Fig. 25-28): Bicarinate along anterior half in the genotype *ciliatus* (Oliv.), *horni* Sharp, *lateralis* Er., *limbatus* Sharp, *liebecki* (Pars.), and *niger* Horn. A small axillary space (Fig. 96,97) is present in the above species.

IV. MESOSTERNUM ALONG MEDIAN LINE WITH POSTERIOR FIFTH TO ONE-HALF OBLIQUELY AND MODERATELY ELEVATED; THE REMAINING ANTERIOR PORTION HORIZONTAL:

Epuraea (Fig. 29, 30): Not carinate. Apparently no axillary space is present except that at least in *avara* (Rand.) and *rufa* (Say) a very small axillary space is discernible (Fig. 98).

Stelidota (Fig. 31, 32): In the genotype *geminata* (Say), *octomaculata* (Say), *ferruginea* Er. (=*strigosa* of Horn (1879) and Parsons (1943) in error), *strigosa* Gyll. (=*strigosa* of Erichson, Reitter, and Sharp), *clavigera* Sharp, *chontalensis* Sharp, *solitaria* Sharp, and *multiguttata* Reit. the mesosternum is not carinate although very rarely a very fine carina may be seen. The axillary space (Fig. 99) is well developed.

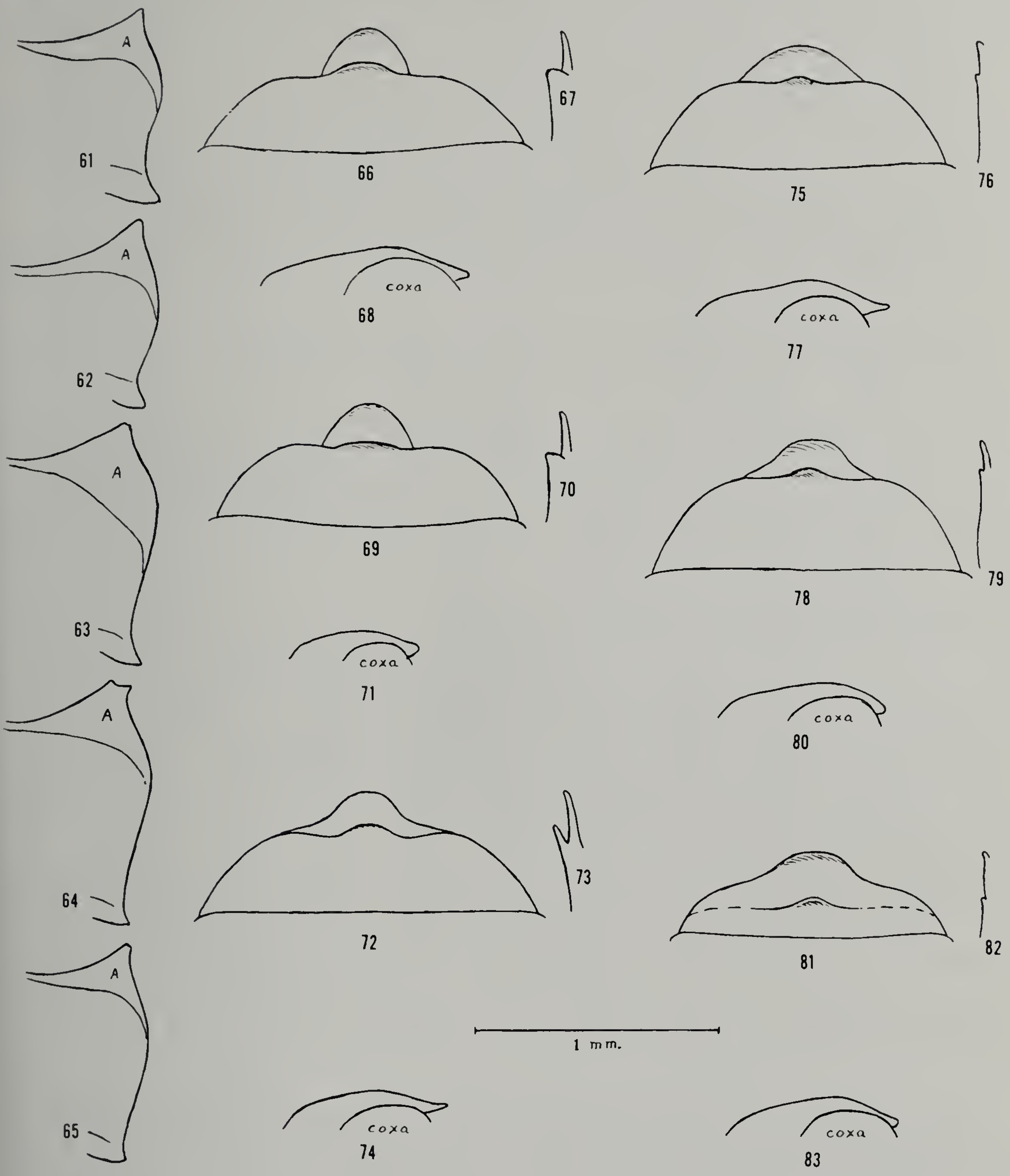

Fig. 61-65: Ventral views of left side of metasternum showing the axillary space [A]. 61) *Psilopyga fasciata.* 62) *Psilopyga* species A. 63) *Psilopyga histrina.* 64) *Psilopyga latus.* 65) *Psilopyga nigripennis.*
Fig. 66,69,72,75,78,81: ventral views of hypopygidia in *Amphicrossus.*
Fig. 67,70,73,76,79,82: lateral profiles of hypopygidia in *Amphicrossus.*
Fig. 68,71,74,77,80,83: lateral profiles of prosterna in *Amphicrossus.* 66-68) *Amphicrossus liebecki.* 69-71) *Amphicrossus niger.* 72-74) *Amphicrossus limbatus.* 75-77) *Amphicrossus ciliatus.* 78-80) *Amphicrossus horni.* 81-83) *Amphicrossus lateralis.*

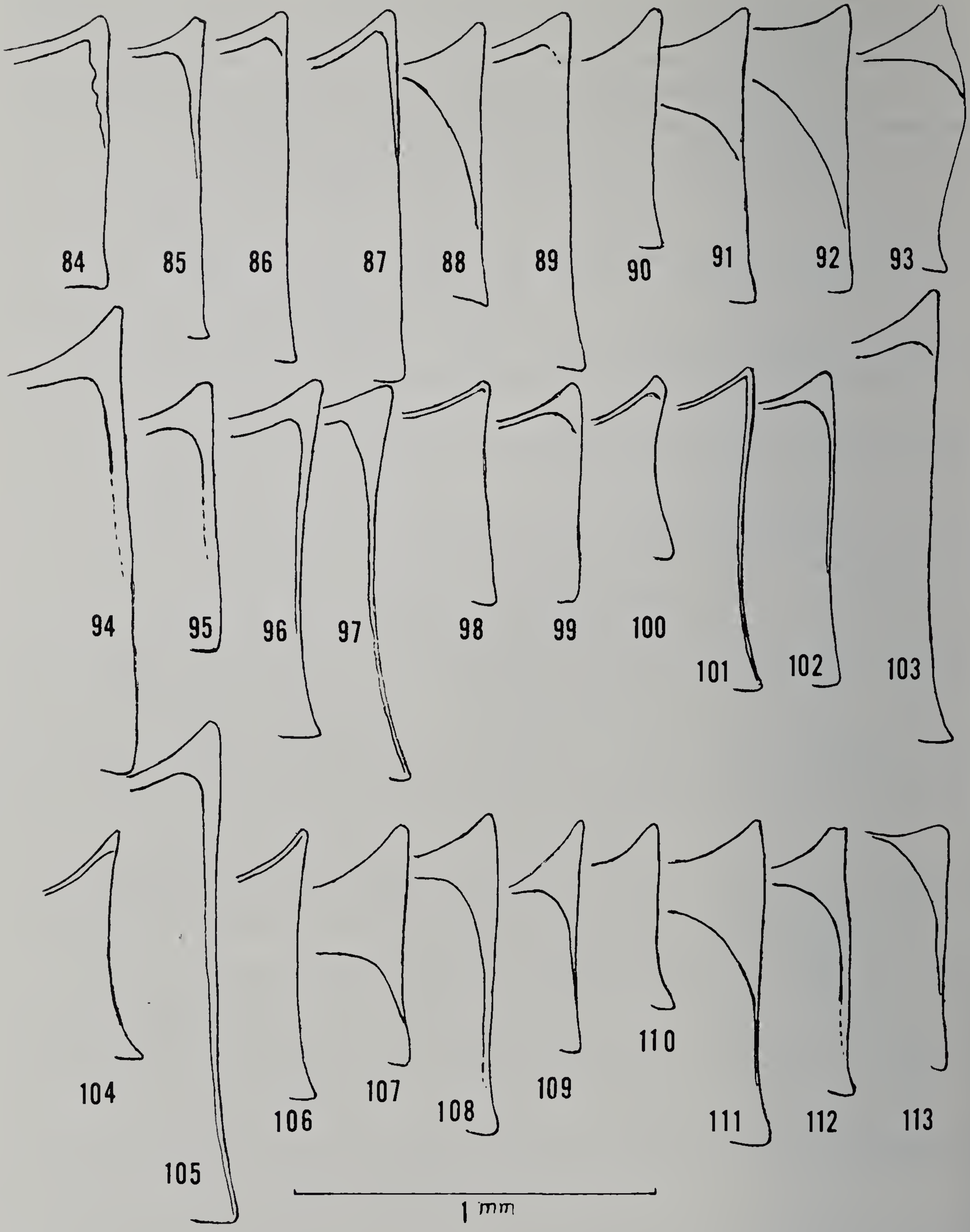

Fig. 84-113: Ventral view of left side of metasternum in certain Nitidulidae. When present the axillary space is shown. 84) *Omosita colon*, 85) *Nitidula bipunctata*, 86) *Lobiopa undulata*, 87) *Soronia guttulata*, 88) *Ipidia variolosa*, 89) *Amphotis ulkei*. 90) *Trimenus adpressus*, 91) *Camptodes texanus*, 92) *Aethina aeneipennis*, 93) *Psilopyga nigripennis*, 94) *Phenolia grossa*, 95) *Physosoronia explanata*, 96) *Amphicrossus ciliatus*, 97) *Amphicrossus liebecki*, 98) *Epuraea avara*, 99) *Stelidota geminata*, 100) *Haptoncus luteolus*, 101) *Thalycra parsonsi*, 102) *Pocadius helvolus*, 103) *Aphenolia monogama*, 104) *Orthopeplus quadricollis*, 105) *Lasiodactylus pictus*, 106) *Pallodes pallidus*, 107) *Pocadites dilatimanus*, 108) *Pocadiodes vajdelota*, 109) *Cychramus adustus*, 110) *Xenostrongylus arcuatus*, 111) *Cyllodes ater*, 112) *Teichostethus guatemalenus*, 113) *Oxycnemus mandibularis* (after Spornraft, not to same scale).

Haptoncus (Fig. 33, 34): In the genotype *ocularis* (Fairm.), *californicus* Gill., and *luteolus* (Er.) the mesosternum is not carinate and there is a small axillary space (Fig. 100).

Thalycra (Fig. 35,36): In the genotype *fervida* (Oliv.), *concolor* (Lec.), *murrayi* (Horn), *carolina* (Wick.), *sinuata* Howd., *mixta* Howd., *truncata* Howd., *dentata* Howd., *parsonsi* Howd., *acuta* Howd., *keltoni* Howd., and *monticola* Howd. there is an obsolete very short carina at the anterior margin, and the axillary space (Fig 101) is very much reduced but distinct.

Pocadius (Fig. 37,38): In the genotype *ferrugineus* (F.), *helvolus* Er., *fulvipennis* Er., *basalis* Schaef., and *niger* Pars. the mesosternum is not carinate and an axillary space (Fig. 102) is present.

Aphenolia (Fig. 39,40): In *monogama* (Crotch) the mesosternum is not carinate. As shown in Fig. 40 the anterior margin of the metasternum between the mesocoxae has a raised impunctate area. An axillary space is present (Fig. 103).

Orthopeplus (Fig. 41,42): In the genotype *quadricollis* Horn the mesosternum is not carinate and there is a very small axillary space (Fig. 104).

V. MESOSTERNUM ALONG MEDIAN LINE STRONGLY ELEVATED AND MORE OR LESS COVERED BY THE PROSTERNAL PROCESS.

Lasiodactylus (Fig. 43,44): In *pictus* Macleay there is an obsolete very short carina at the anterior margin and there is a small axillary space (Fig. 105).

Pallodes (Fig. 45,46): In the genotype *pallidus* (Beauv.), *plateosus* Schaef., *mexicanus* Sharp, and *umbratilis* Reit. the mesosternum is carinate and there is no axillary space (Fig. 106).

Pocadites (Fig. 47,48): In *dilatimanus* Reit. the mesosternum is not carinate and there is a large axillary space (Fig. 107).

Pocadiodes (Fig. 49,50): In the genotype *vajdelota* (Wank.) the mesosternum is not carinate and there is a large axillary space (Fig. 108).

Cychramus (Fig. 51,52): In the genotype *luteus* (Fabr.) the carina is well developed, whereas in *adustus* Er. and *henoni* Fairm. the carina is slightly developed at anterior margin and absent in *variegatus* (Herbst). The axillary space is well developed in the above species (Fig. 109).

Atarphia (Not figured): In the genotype *fasciculata* Reit. the mesosternum is not carinate and there is a large axillary space.

Xenostrongylus (Fig. 53,54): In *arcuatus* Kiesw., *deyrollei* Jac. du Val, and *histrio* Woll. the mesosternum is not carinate and there is no axillary space (Fig. 110).

Cyllodes (Fig. 55,56): In the genotype *ater* (Herbst), *biplagiatus* Lec., and *binotatus* Reit. the mesosternum is carinate and strongly elevated but with the two posterior angles, between the mesocoxae, descending to the level of the metasternum. The axillary space (Fig. 111) is well developed in the above species.

Teichostethus (Fig. 57,58): In *guatemalenus* Sharp the mesosternum is carinate and strongly elevated but with the 2 posterior angles, between the mesocoxae, descending halfway to the level of the metasternum. The axillary space is well developed (Fig. 112).

Oxycnemus (Fig. 59,60): In the genotype *fulvus* Er., *rostrosus* Reit., and *nigriceps* Reit. the mesosternum is strongly elevated and not carinate. There is a well developed axillary space (Fig. 113).

Oxycnemus COMPARED WITH *Psilopyga*

This description of *Oxycnemus* is based on a male *fulvus* Er. from ?BRAZIL [B.M.], a male *rostrosus* Reit. from PANAMA: Chiriqui Prov., Bugaba [B.M.]. and a male *nigriceps* Reit. from VENEZUELA [LRG]. The description of *Psilopyga* is based on *histrina* Lec., *nigripennis* Lec., *fasciatus* Sharp, *latus* (Spornraft), and *lewisi*(Reit.).

Medium size (length 3.7-7.8mm), oval, convex, glabrous. Head short, clypeus moderately distinct, labrum distinctly bilobed but twice as deeply bilobed in *Psilopyga.* Antennae longer than head; 1st segment much enlarged, as long as 2nd and 3rd combined; segments 2-6 inclusive slender, 2nd as long as 3rd and 4th combined, 6th and 7th segments very short, 7th twice as wide as 6th and really forming part of the club, so the club can be said to be formed of 5 segments. But only the terminal 4 segments are pubescent, the remainder being glabrous. In *Psilopyga* the terminal 3 segments are densely pubescent and the club can be considered to be formed of 4 segments. Antennal grooves long, parallel, but much less distinct in *Psilopyga.* Mandibles apparently similar in the two genera except that they are very greatly enlarged in *Oxycnemus mandibularis* and *rostrosus.* Maxillary and labial palpi much longer and more slender in *rostrosus* than in *fulvus* which has longer palpi than *Psilopyga.* Mentum very feebly notched anteriorly in *fulvus,* distinctly notched in *rostrosus,* but in *Psilopyga* not at all notched and rounded (except feebly notched in 1 *nigripennis*).

Pronotum more strongly emarginate anteriorly than in *Psilopyga,* nearly as wide as elytra; pronotum posteriorly with short truncate lobe which is slightly narrower than scutellum. The scutellum is large, triangular, with lateral margins sinuate, whereas in *Psilopyga* the sides are not sinuate. Elytra with apices truncately rounded exposing most of the pygidium, epipleurae broad, attaining the apices, and pubescent; whereas in *Psilopyga* the epipleurae are glabrous.

Apex of prosternal process (Fig. 59) strongly elevated behind the procoxae and convex, whereas in *Psilopyga* the apex of the prosternal process (Fig. 19) is not elevated behind the procoxae and is depressed. Mesosternum (Fig. 60) not carinate but is strongly elevated, whereas in *Psilopyga* the mesosternum (Fig. 20) is carinate and on the same level with the metasternum. The inner margin of the metepisternum is nearly straight, whereas in *Psilopyga* it is distinctly sinuate. The eighth dorsal segment of the male is not visible dorsally, whereas it is clearly visible in *Psilopyga.* Male pygidium rounded and with raised margin, whereas in *Psilopyga* male pygidium is truncate to feebly emarginate and without raised margin. The tegmen is about equal in length to the median lobe, whereas in *Psilopyga* the tegmen is about twice as long as the median lobe (Spornraft 1971).

Oxycnemus Erichson

Oxycnemus Er., 1843, *in* Germar, Zeitschr. für Ent. 4:351.
Genotype: *Oxycnemus fulvus* Er.

Very recently Spornraft (1971) has revised *Oxycnemus*, recognizing *Psilopyga* as a subgenus. For reasons enumerated above I believe *Psilopyga* should receive generic rank. Arguments for its separation appear stronger than those for separating a number of genera in the nitidulids.

As here restricted this genus is Neotropical, including the following species from BRAZIL: *annulipes* Reit., *aterrimus* Reit., *mandibularis* Sporn., and *ruficollis* Grouv. plus *fulvus* Er. (Brazil to Panama), *nigriceps* Reit. (Brazil, Venezuela), *rostrosus* Reit. (Mexico to Panama), and *nigritus* Reit. from South America. But I have seen only *fulvus*, *nigriceps*, and *rostrosus*.

Psilopyga Leconte

Psilopyga Lec., 1853, Proc. Acad. Nat. Sci. Philadelphia 6:286.
Genotype: *Psilopyga histrina* Lec.

Eugoniopus Reit., 1884, Wiener Ent. Zeit. 3: 264, 267.
Genotype: *Eugoniopus lewisi* Reit.

It was Leconte (1883, p. 151) who made *Psilopyga* a synonym of *Oxycnemus*. Evidently he did not know the genotype of the latter. Sharp (1891) reinstated *Psilopyga* and made *Eugoniopus* a synonym of *Psilopyga*. Although Blatchley (1910) followed Sharp, Grouvelle (1913), Parsons (1943), and Gillogly (1965) followed Leconte.

As here restricted *Psilopyga* is Holarctic and Oriental, comprising 3 species from the eastern United States: *histrina* Lec., *nigripennis* Lec., and *latus* (Spornraft); plus *fasciatus* Sharp (Mexico and Arizona), *lewisi* (Reit.) (Japan), and *reitteri* (Grouv.) (Burma). I have not seen *reitteri*. The axillary space of *latus* as shown in Fig. 64 is deemed more correct than the one depicted by Spornraft (1971). Sadanari Hisamatsu (personal communication) writes that he has a "new Indian species belonging to *Psilopyga*".

There is an apparently undescribed species, designated Species A, represented by 1♂ from Patagonia, Arizona [LRG] and 1♂ from the Huachuca Mts., Arizona [KS]. It differs from *nigripennis* in being less oval, prothorax less emarginate and less narrowed anteriorly, in having a small pale humeral area on each elytron, and in a larger axillary space (Fig. 62).

Amphicrossus Erichson

Amphicrossus Er., 1843, *in* Germar, Zeit. für Ent. 4:346.
Genotype: *Nitidula ciliatus* Oliv.

The following account is a supplement to my previous papers (1939, 1943). Some additional characteristics of this genus are the bicarinate mesosternum and the unusual development of the male hypopygidium which appears to be composed of 2 coalesced sternites. This character offers a good method for differentiating species and so is figured below.

KEY TO NEW WORLD *Amphicrossus*

1. Oblong, width to length ratio: 1 to 1.8-2 or more, moderately convex, dark brown 2
1′. Oval, width to length ratio: 1 to ±1.5 (except 1 to ±1.8 in *niger* which is black); strongly convex, except moderately so in *niger* 3

2(1). Smaller, length 4.5-4.7mm; width to length ratio: 1 to 2+; no tubercles on elytra; male with shiny subquadrate lobe near middle of hypopygidium; male with pencil of setae on each elytron, before the middle (Argentina) .. *vicinus* Grouv.
2′. Larger, length 5.2-6.6mm; width to length ratio: 1 to 1.8; elytra with vague rows of obsolete setigerous tubercles; male with punctate rounded lobe about one-third from posterior margin of hypopygidium (Fig. 66). no pencil of setae on each elytron in the male (Arizona) .... *liebecki* Pars.

3(1′). Color above unicolorous; lateral elytral fimbriae narrow, only as long as width of first antennal segment 4
3′. Color above fuscous with obscure pale markings; lateral elytral elytral fimbriae broad, noticeably longer at middle, at least twice as long as width of first antennal segment 5

4(3). Moderately convex; less oval than *limbatus*; black; punctures on disc of pronotum separated by 3 times their diameter; posterior margin of pronotum not bisinuate; no pencil of setae on elytron of male. Hypopygidium Fig. 69, 70; prosternum Fig. 71 .... *niger* Horn
4′. Strongly convex; uniformly fuscous above; punctures on disc of pronotum much finer and separated by 4 or 5 times their diameters; posterior margin of pronotum distinctly bisinuate; male with pencil of setae on each elytron at or near the sutural margin. Hypopygidium Fig. 72, 73; prosternum Fig. 74 .... *limbatus* Sharp

5(3′). Elytral fimbriae slightly longer at middle than at anterior or posterior third, being about twice as long as width of first antennal segment; pygidium shagreened; punctures on pronotum much more coarse. Hypopygidium Fig. 75, 76; prosternum Fig. 77 .... *ciliatus* (Oliv.)
5′. Elytral fimbriae distinctly longer at midddle than at anterior or posterior third, being about 2½ times as long as width of first antennal segment. Pygidium not distinctly shagreened, more shining; punctures on pronotum finer, separated by 3 or 4 times their diameter 6

6(5′). Hypopygidium of male (Fig. 81,82) with a small, shiny, adpressed lobe about half way between anterior and posterior margins measured along middle; posterior margin of male hypopygidium more broadly rounded; prosternal process in profile more elevated behind the procoxae (Fig. 83); a longitudinal dark band usually evident occupying about half the pygidial width (Brazil) .... *lateralis* Er.

6′. Hypopygidium of male (Fig. 78,79) with a small, shiny, glabrous, adpressed lobe about one-third from the posterior margin, area posterior to the lobe feebly concave; posterior margin of male hypopygidium less broadly rounded; prosternal process in profile less elevated behind the procoxae (Fig. 80); pale markings of upper surface more obscure; dark band on pygidium not usually evident (Guatemala, Panama) .... *horni* Sharp

Amphicrossus vicinus Grouvelle

Amphicrossus vicinus Grouvelle, 1916, Rev. Mus. La Plata 23:245-6.

I have not seen this species. It is based on a pair collected by Carlos Bruch in the Province of Buenos-Aires, Argentina and is in his collection at the Mus. Argent. Cienc. Nat. Bernard.

Amphicrossus liebecki (Parsons), NEW COMBINATION

(Fig. 27,28,66,67,68)

Epuraea liebecki Parsons, 1943, Bull. Mus. Comp. Zool 92:189.

With more material available this species is now redescribed. It is placed in *Amphicrossus* even though it has elytral tubercles and is more oblong and less convex than is usual in this genus. Also *A. niger* Horn is intermediate in convexity and outline between *liebecki* and the other New World species. The male hypopygidium shows a strong relationship to *niger*.

Unusually large, length 5.2-6.6mm, distinctly more depressed, more oblong than is usual in the genus; lateral margins of prothorax and elytra easily visible from above. Lateral fringe of hair much shorter than in *ciliatus*, about as long or slightly shorter than in *niger*. Color above dark fuscous, beneath pale fuscous including antennae and legs. Vertex with punctures separated by their diameters; larger punctures as large as eye facets. Prothorax with average length to width ratio: 1 to 1.82 (holotype: 1 to 1.74). Because the prothorax is partially deflexed, total length is not a significant figure. Therefore dimensions are given as follows: length of prothorax: holotype 1.9mm, average 1.82mm, range 1.6-2.1mm; width of prothorax: holotype 3.3mm, average 3.3mm, range 2.8-3.7mm; length of elytra: holotype 3.7mm, average 3.56mm, range 3.2-4.2mm; width of elytra: holotype 3.3mm, average 3.23 mm, range 2.9-3.7mm; Pronotal surface densely punctate, punctures separated by about their diameters, each puncture bearing a dark fulvous recumbent hair; intervals finely granulose. The sutural three-fifths of each elytron with about 7 vague rows of obsolete tubercles, each tubercle bearing a recumbent dark fulvous hair twice as long as the hairs borne by the punctures in between which are separated by about twice their diameters. Punctation of pronotum, elytra, and pygidium much denser than in *ciliatus* or *niger*. Male mesotibia feebly expanded on inner side at apex, whereas the male mesotibia of *niger* and *ciliatus* are simple.

This rare species is known from southern ARIZONA where it is usually collected at blacklight. Holotype male, state label, Liebeck coll. [MCZ]; paratype male, state label [CTP]; paratype male, Huachuca Mts., Carr Canyon, 14-VII-36, M. Cazier [AMNH]; male Patagonia Mts., west slope on Lochiel Rd., 5330 ft., mesquite-chaparral, 14-VII-48, F. Werner, W. Nutting [CTP]; female, Huachuca Mts., Ramsey Canyon, 5350 ft., 10-19-VI-66, F. Werner [U.A.]; male, female, Pajarito Mts., Pena Blanca Canyon, 11-VII-70, K. Stephan [KS]; male, Santa Rita Mts., Madera Canyon, 22-VI-68, K. Stephan [KS]; male, Santa Rita Mts., Madera Canyon, 9-VIII-61, F. Werner, W. Nutting [UA].

Amphicrossus niger Horn

(Fig. 69-71)

Amphicrossus niger Horn, 1879, Trans. Amer. Ent. Soc. 7:317.

This species occurs in southern ARIZONA in old wounds on mesquite trees.

Amphicrossus limbatus Sharp

(Fig. 72-74)

Amphicrossus limbatus Sharp, 1891, Biol. Centr.-Amer. 2(1):349.

This species is known by the male lectotype and female paralectotype from GUATEMALA: Alta Verapaz, Chiacam (male) and Teleman (female) [BM]. Examined. Also 9 specimens [USNM] from PANAMA: Canal Zone, Barro Colorado, June, July, Aug., Sept., 1937, 1942, James Zetek. Two were taken in a fruit fly trap.

In the writer's collection is a female which keys to *limbatus* but differs in having coarser punctation, as in *ciliatus*, and pygidium much less convex, as in *limbatus*. It was taken by F. Werner and W. Nutting in MEXICO: Guerrero, El Gavilan, 13 km. north of Taxco, 5300 ft., oak-pine scrub, 21-VI-48.

Amphicrossus ciliatus (Olivier)

(Fig. 75-77)

Nitidula ciliatus Olivier, 1811, Encycl. Meth. 8:210.

The type of this species "sur les ulcéres du *Liquidambar* en Caroline" could not be found on a recent visit to the Paris Museum. At Wheatly, Ontario, Karl Stephan collected it at sap of poplar on April 3, and at Edgewood Arsenal, Maryland, Alan Gillogly collected it at sap of chestnut oak in mid June. It ranges from Ontario to Florida west to Iowa, Missouri, and Texas (Dallas, Burnet). Also E. A. Schwarz took a specimen on Ceiba on Jan. 22 at Cayamas, CUBA [USNM]. My 1943 record for Old Panama is based on my misidentification of *horni*.

Amphicrossus lateralis Erichson

(Fig. 81-83)

Amphicrossus lateralis Er., 1843, *in* Germar, Zeit. für Ent. 4:348.

The type is from BRAZIL, Para (not examined). The British Museum has 6 specimens from BRAZIL: St. Paulo; Amaz[on]; Tejuca, 1-I-1857, H. Clark; St. Fe de Bogata, labelled "*Strongylium bispinosus* Dup."

This species is evidently closely related to *horni*. The lateral fimbriae, punctation, placement of male pencils of setae, posterior margin of pronotum are all as in *horni*.

Amphicrossus horni Sharp

(Fig. 78-80)

Amphicrossus horni Sharp, 1891, Biol. Centr.-Amer. 2(1):349.

Type material: a series from GUATEMALA: Alta Verapaz, Teleman and Chacoj, G. C. Champion [BM]; Suchitepéquez, San Isidro, 1600 ft., at sap, G. C. Champion [BM]. Examined. There are also 3 from PANAMA: Old Panama, 31-I-11, E. A. Schwarz [USNM] (2); Barro Colorado Island, 23-24-V-40, James Zetek [USNM] (1).

ACKNOWLEDGEMENTS

At the British Museum I enjoyed the hospitality of R. D. Pope and the loan of specimens by C. M. T. vonHayek. Sadanari Hisamatsu has generously given me many critical genera. Also L. R. Gillogly kindly lent his valuable series of *Oxycnemus* including the holotype of *latus* Spornraft. Other curators and collectors listed below have been most helpful:

American Museum of Natural History [AMNH], Lee Herman; British Museum of Natural History [BM]; California Academy of Sciences [CAS], Hugh B. Leech; Carl T. Parsons [CTP]; Karl Stephan [KS]; Museum of Comparative Zoology [MCZ], John Lawrence; University of Arizona [UA], Floyd Werner and M. L. Noller; United States National Museum [USNM], J. M. Kingsolver.

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DESCRIPTION OF A NEW SPECIES OF *ALGAROBIUS* BRIDWELL (COLEOPTERA: BRUCHIDAE)

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Abstract

Description of a new species of Bruchidae, *Algarobius bottimeri*, is given. This species is found in at least 60 counties in southern and central Texas, in northeastern Mexico, and has been introduced into Hawaii. Characters to separate it from *Algarobius prosopis* LeConte are given.

Because of the need for a name to be used in various biological studies on insects of *Prosopis*, the following description is provided. A more complete analysis of this genus is in preparation.

Algarobius bottimeri Kingsolver, NEW SPECIES

Bruchus prosopis LeConte, 1858:77 (of authors, not LeConte, 1858:77, especially records from Texas and Hawaii)
Algarobius prosopis (of authors, in part.)

Color of male: Integument dark red, except eyes and humeri black; vestiture of gray, brassy, yellowish and piceous slender setae; pronotum yellowish in appearance but with narrow, median condensation of gray setae, pleura gray; elytra mottled gray and brassy with faint lateral maculae; pygidium mottled yellowish and gray, with median condensation of gray setae and faint spot either side of median line; venter evenly clothed with gray setae.

Color of female: Integument dark red to piceous, dorsal pattern of pronotum and elytra more strongly pronounced than in male; pronotal disk usually of bronzy appearance with median gray stripe and pleura gray; elytra mottled bronzy and gray with median sutural spot dark brown, third interval gray with small brown spot just behind middle; mediolateral maculae brown reaching fifth interval, intervals 2, 4, 6, and 8 with elongated, brown apical spots; humeri piceous; pygidium with 2 elongated black sulci flanking darker median stripe (Fig. 5).

Head length (dorsal margin of eye to apex of labrum) slightly less than width across eyes; interocular width 3/8 width across eyes; ocular sinus 1/2 length of eye; posterior margin of eye with narrow fringe of gray setae, frontal carina faintly indicated in some specimens but usually represented by impunctate median line; vertex and frons with fine, linear, setose punctures; clypeus finely, densely punctate; labrum impunctate. Antenna (Fig. 7) not sexually dimorphic.

Pronotum campaniform, disk evenly convex with 4 slight depressions on basal margin; punctation fine, unevenly distributed, nearly concealed by vestiture.

Scutellum elongate, 2x as long as width at base, apex bidentate (Fig. 3).

Elytra together about 2x as long as wide; lateral margins arcuate, disk evenly convex; humeri not prominent, bare, finely scabrous; striae regularly placed, not laterally distorted at bases, faintly impressed and nearly concealed by vestiture, striae 2, 3, 4, 5, and usually 6 each with a small, basal denticle.

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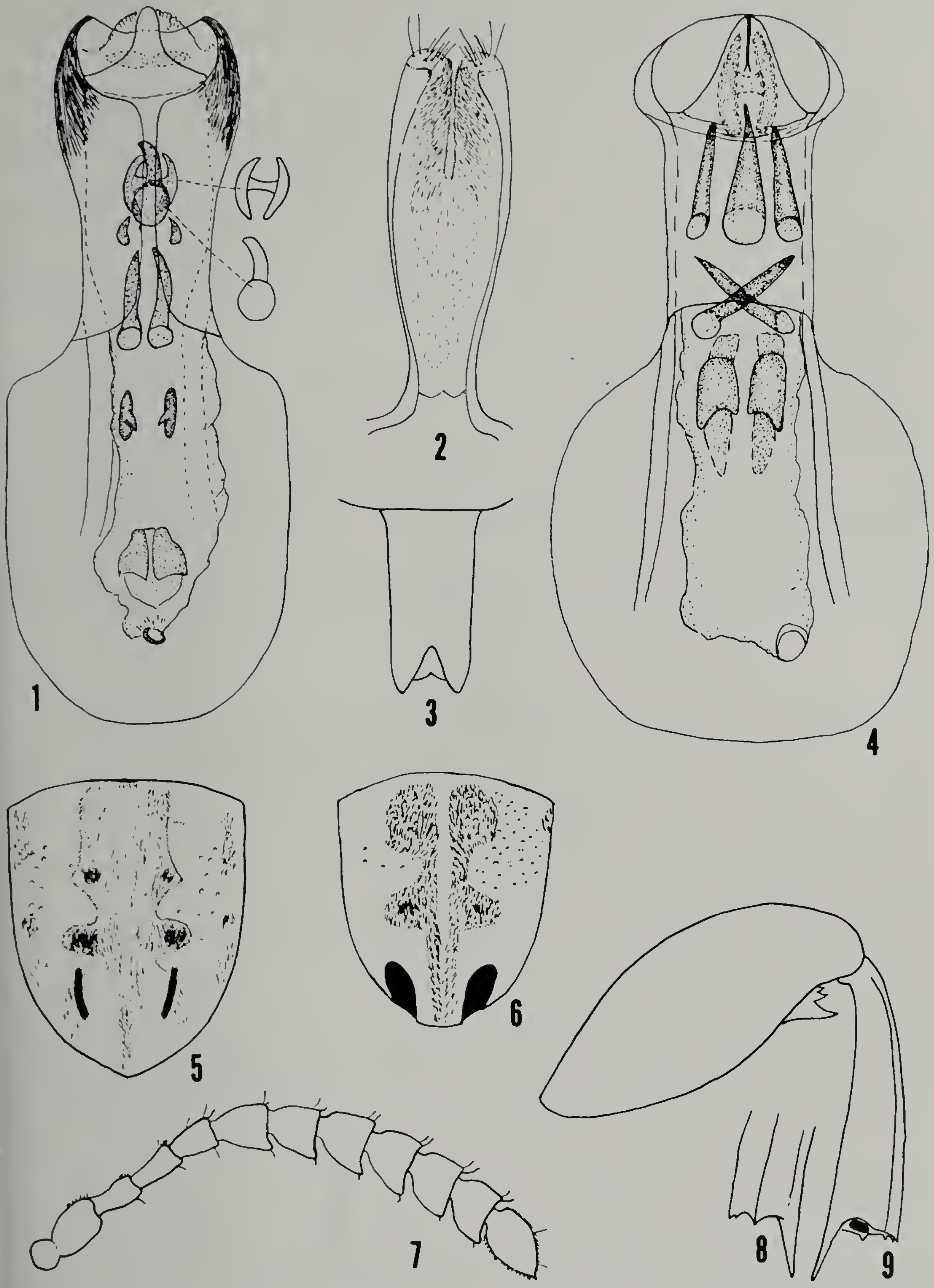

Fig. 1-3, 5, 7-9: *Algarobius bottimeri*, n. sp. 1) ♂ genitalia, median lobe, ventral. 2) lateral lobes, ventral. 3) scutellum. 5) ♂ pygidium. 7) antenna. 8) hind tibia, apex, lateral. 9) hind femur and tibia, mesal. Figs. 4, 6: *Algarobius prosopis* LeConte. 4) ♂ genitalia, median lobe, ventral. 6) ♀ pygidium.

Legs: Front and middle legs not modified, hind leg as in Fig. 8, 9.

Pygidium of ♂ with postero-dorsal face finely, irregularly punctate, slightly convex, reflexed anteriad at apex fitting shallow emargination of terminal sternite of abdomen; of female with surface punctation as for ♂ but with two longitudinal, polished, black or darkened sulci in apical 1/2 removed from apical margin by a distance equal to their length, pygidium slightly tumescent between sulci (Fig. 5).

Male genitalia (Fig. 1, 2): Median lobe with apex emarginate, lateral margins thickened, massive; ventral valve subtriangular; armature of internal sac as illustrated, H-shaped sclerite characteristic of genus; lateral lobes flattened (Fig. 2), setate apically, cleft 1/3 their length.

Measurements: Body length, apex of pronotum to apex of pygidium: 2.75-4.25mm; body width at widest measurement: 1.50-2.25mm.

Holotype male: TEXAS: Mission, Bentsen St. Pk. (Hidalgo Co.), 10-11-VIII-63, P. J. Spangler [USNM Type 70389]. *Allotype female* and 433 male and female paratypes, same data.

Additional specimens examined (not paratypes): many specimens from the following counties in TEXAS: Aransas, Atascosa, Bee, Bexar, Blanco, Brewster, Briscoe, Brooks, Brown, Cameron, Cole, Coleman, Collingsworth, Comal, Concho, Crockett, Dallas, Denton, Dickens, Dimmit, Duval, Eastland, Edwards, Floyd, Frio, Garza, Gillespie, Glasscock, Gonzales, Hall, Hidalgo, Howard, Hudspeth, Jim Wells, Jones, Karnes, Kenedy, Kerr, Kin-

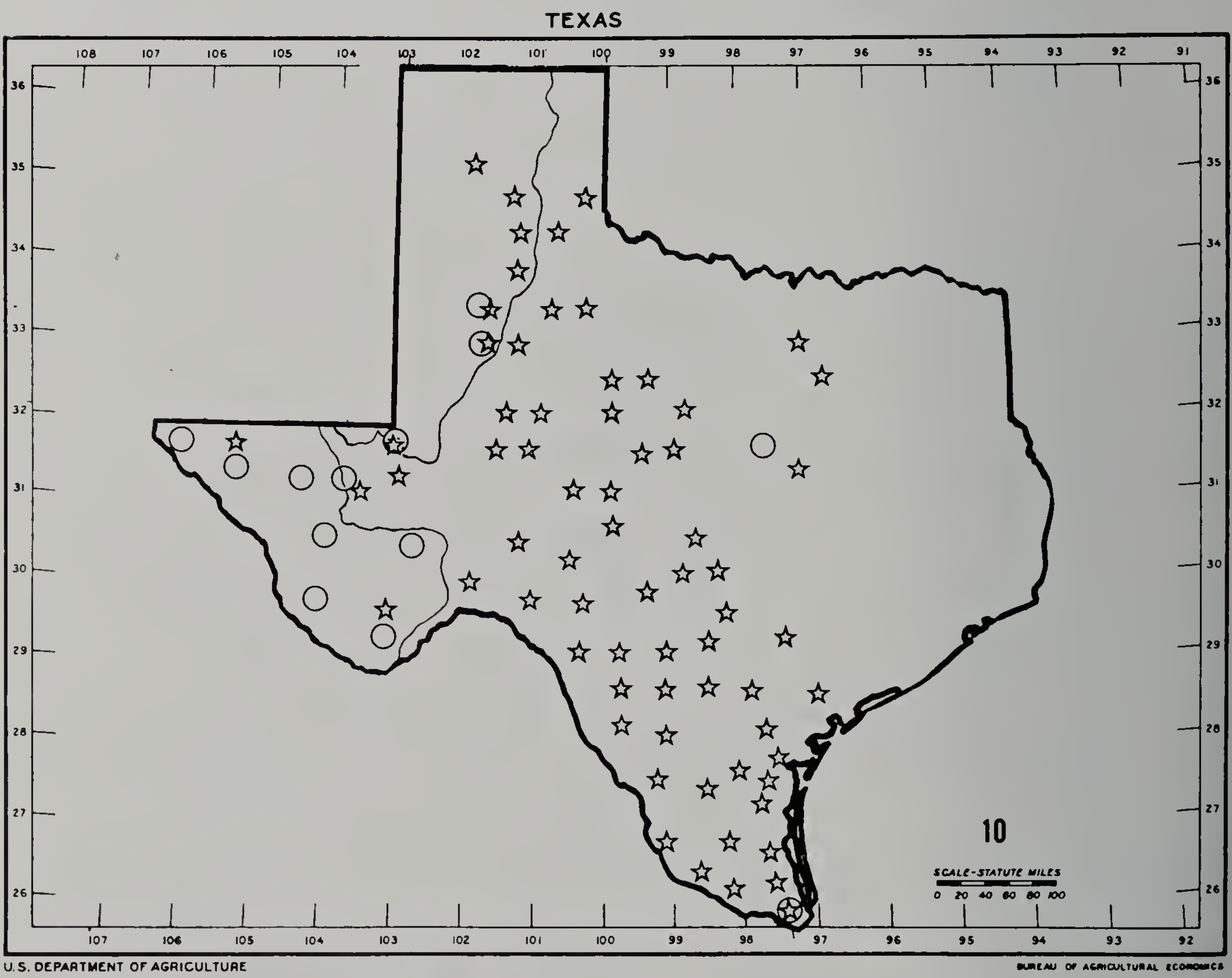

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Fig. 10: Known distribution of *Algarobius bottimeri*, n. sp., and *A. prosopis* LeConte in Texas. Line indicates western limits of Edwards Plateau. Stars indicate distribution of *A. bottimeri*, open circles distribution of *A. prosopis*.

ney, Kleberg, LaSalle, Llano, Lubbock, Lynn, McLennan, Medina, Menard, Mitchell, Nueces, Reeves, San Patricio, Shackleford, Starr, Sterling, Sutton, Taylor, Terrell, Tom Green, Uvalde, Val Verde, Victoria, Ward, Webb, Willacy, Zapata, Zavala. NEW MEXICO: Lea Co. MEXICO: NUEVO LEON: Liñares, Monterrey; TAMAULIPAS: Guemes, Ciudad Victoria. HAWAII: MAUI: Lahaina; KAHOOLAWE; OAHU: Honolulu, Mt. Kaala, Pearl City, Koko Head, Wailupe, Koolau Mts. Approximately 3000 specimens were at hand, collected from February through November.

Paratypes are deposited in the following institutional and private collections: American Museum of Natural History, New York; University of Arizona, Tucson; Bernice P. Bishop Museum, Honolulu; British Museum (NH), London; Canadian National Collections, Ottawa; California Academy of Sciences, San Francisco; Carnegie Museum, Pittsburg; Cornell University, Ithaca; Field Museum of Natural History, Chicago; Charles Griffin, Corpus Christi; Henry Howden, Ottawa; C. D. Johnson, Flagstaff; University of Kansas, Lawrence; Museum of Comparative Zoology, Cambridge, Mass.; Museum National d'Histoire Naturelle, Paris; Naturhistoriska Riksmuseum, Stockholm; Texas A & M University, College Station; Texas Tech University, Lubbock; U. S. National Museum, Washington, D. C.; G. B. Vogt, Washington, D. C.

I wish especially to thank Mr. Larry J. Bottimer, Tow, Texas, for so generously turning over to me many specimens which he reared. These are now part of the Canadian National Collection, Ottawa. I am naming this species for him in recognition of the important contributions he has made to the knowledge of bruchid biology.

DISCUSSION

This species has been identified as *Algarobius prosopis*, but *prosopis* is in a different species group. I have been unable to find any character other than male genitalia to separate the ♂ of *bottimeri* from the ♂ of *prosopis*; however, it is not necessary to clear the genitalia in order to distinguish them. Specimens need only to be relaxed and the median lobe pulled out sufficiently to examine the condition of the apex of the median lobe: a dark, massive, emarginate form in *bottimeri* contrasted with a lightly sclerotized, hoodlike form in *prosopis* (Cf. Fig. 1 and 4). Identification using the armature of the internal sac requires clearing of the median lobe in KOH.

Identification of females from localities north of the Rio Grande can be made by comparing the pygidium with Fig. 5 and 6. In *prosopis*, the pygidal sulci are adjacent to the apical margin (Fig. 6), but in *bottimeri*, the sulci are separated from the apical margin by a distance about equal to their own length (Fig. 5).

Algarobius bottimeri is most closely related to an undescribed species from Oaxaca, Mexico, whereas *prosopis* belongs to a group of species whose range extends through the central plateau of Mexico.

The genus *Algarobius* apparently is restricted in host relationships to *Prosopis*, commonly known as mesquite. Opinions vary among botanists as to which names should be used for the species and varieties of *Prosopis* in North America, but Johnston (1962) is of the opinion that *Prosopis glandulosa* var. *glandulosa* should be applied to a form found over most of Texas extending west to the limits of the Edwards Plateau. In comparing the range of *A. bottimeri* with that of the variety *glandulosa*, the coincidence of range is striking (Fig. 10). In addition, the eastern limits of the range of *A. prosopis* overlaps that of *bottimeri* in a narrow band extending from the middle of the Texas panhandle to the Big Bend roughly along the Plateau limits. According to Johnston (1962, map, p. 73), *Prosopis glandulosa* var. *torreyana* extends eastward approximately to the same limits. Not enough localities are known from Mexico to detect any distribution patterns south of the Rio Grande. The Hawaiian records obviously result from the introduction of *Prosopis* into the Islands in the early twentieth century for cattle feed. Bridwell (1929:43) recognized that the species he and others had listed as *Bruchus prosopis* was undescribed. Since no one described it as new, subsequent workers in Hawaii have continued to use the names *Bruchus prosopis* or *Algarobius prosopis*.

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LITERATURE NOTICE

Karren, J. B. 1972. A revision of the subfamily Chlamisinae of America North of Mexico (Coleoptera:Chrysomelidae). Univ. Kansas Sci. Bull. 49(12):875-988; 160 fig., 13 distribution maps.

Edmonds, W. D. 1972. Comparative skeletal morphology, systematics and evolution of the phanaeine dung beetles (Coleoptera:Scarabaeidae). Univ. Kansas Sci. Bull. 49(11):731-874; 317 fig., 3 tables.

Anyone who has tried to get a large manuscript published soon realizes the high costs and the relatively few outlets for such papers. These 2 fine publications are the results of Ph.D. studies at the University of Kansas. The University, particularly those responsible for the publication of the "Science Bulletin", is to be commended for assuring the high quality publication of such fine monographs as these 2 on beetles.—R. E. Woodruff

A NEW SPECIES OF *ANCHASTUS* FROM ARIZONA AND BAJA CALIFORNIA (COLEOPTERA: ELATERIDAE)

Edward C. Becker
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Ottawa KIA OC6

Abstract

Anchastus knulli n. sp. from southern Arizona and Baja California is described and illustrated. The absence of a key generic character on adults of this species is discussed.

Specimens of the following new species of *Anchastus* have been found in the Canadian National Collection (CNC) and in several other collections. I am indebted to the following individuals for the loan of specimens: J. N. Knull (JNK), Ohio State University, Columbus; M. W. Stone (MWS), Riverside, Calif.; F. G. Werner, University of Arizona (UA), Tucson; R. H. Arnett, Jr. (RHA; now in Florida State Collection of Arthropods, FSCA, Gainesville), Tallahassee, Fla.; H. B. Leech, California Academy of Sciences (CAS), San Francisco; and G. H. Nelson, Raytown, Mo.

I wish to thank Dr. H. F. Howden, Carleton University, Ottawa, for the use of the scanning electron microscope with which the photographs were taken.

Anchastus knulli Becker, NEW SPECIES

Males & females: Length 7.9-10.7mm (males), 9.5-10.0mm (females); width 2.5-3.4mm (males), 2.8-3.0mm (females). Color uniformly reddish-brown, epipleurae and legs occasionally slightly lighter in color. Pubescence rather conspicuous, golden-brown, erect. Eyes normal, larger in male, ocular index (see Campbell & Marshall, 1964) 62-67 (males), 67-70 (females). Antenna serrate, extending about 1 segment beyond apex of hind angle of pronotum (males), or failing to reach apex by 1 segment (females); without carina on outer surface; second segment attached to apex of first (see Schaaf, 1970), short, globular; third segment about 3 times longer than second and slightly longer than fourth; third to tenth segments each about one and a half times longer than wide. Frontal carina very distinct throughout. Pronotum very slightly wider than long, widest at base (not including hind angles); sides straight, gradually narrowing to the rounded anterior angles; punctures simple to slightly umbilicate and separated by a distance equal to half their diameters on disc; punctures larger, definitely umbilicate and closer on sides; interspaces smooth, shiny; slight median groove on basal half; hind angles divergent, usually in line with side margins, distinctly bicarinate with outer carina parallel to side margin and extending well beyond base of hind angle and with inner carina shorter and closer to inside margin of hind angle than to outer carina. Scutellum oval, slightly convex. Elytra about 2.3 times longer than wide; sides parallel on basal two-thirds, then narrowed to rounded apex; strial punctures usually connected longitudinally by a very shallow groove; intervals convex, punctulate.

Prosternal sutures strongly excavate. Undersides with punctures finer than those on pronotum, interspaces finely reticulate. Hind coxal plate (Fig. 1) greatly expanded with a rounded or a weakly pointed tooth on the inner third. Each tarsus with third segment simple (slightly projected on underside, but not lobed as in all other species of *Anchastus*); hind tarsus (Fig. 2) with first segment elongate, length subequal to distance from base of second segment to middle of fifth; tibial spurs prominent.

Male genitalia (Fig. 3-5): struts on median lobe long, subparallel; basal piece with apical edge (ventral side) broadly "U" shaped or with a small median projection.

Type material: Holotype male. ARIZONA: Madera Canyon, Santa Cruz Co., 5-VII-63, 4,880 ft. J. S. Buckett [CNC Type No. 12, 685]. Allotype female, same data as holotype except 15-VII-63, V. L. Vesterby [CNC]).

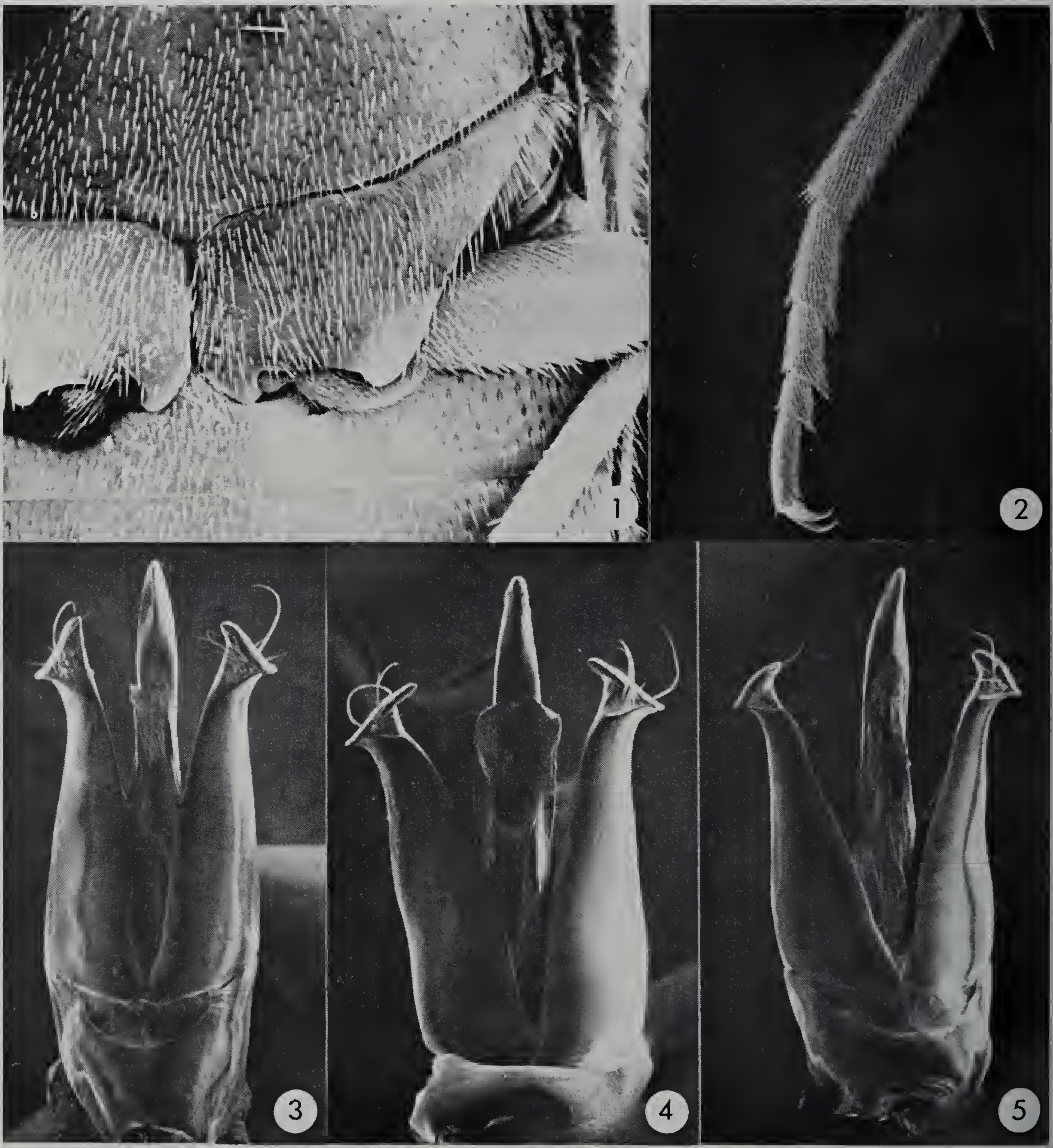

Fig. 1-5: *Anchastus knulli* n. sp. 1) hind coxal plate; 2) hind tarsus; 3-5) male genitalia (3, holotype, Madera Canyon; 4, paratype, Madera Canyon; 5, paratype, San Ignacio). Fig. 4 and 5 are slightly distorted because the apex of each lateral lobe is bent upwards.

Paratypes: 25 males and 3 females from the following localities. ARIZONA: same data as holotype except 18-VI-65, D. N. Harrington [MWS] (1 male); 2-VII-65, D. N. Harrington [MWS] (male); 27-VII-65, D. N. Harrington [MWS] (1 male); Madera Canyon, Pima Co., 8-IX-63, V. L. Vesterby [MWS, CNC] (1 male, 1 female); Chiricahua Mts., D. J. and J. N. Knull from the following dates: 30-VI-69 [JNK] (1 male); 1-VII-68 [JNK] (1 male); 6-VII-67 [JNK] (1 male); 8-VII-67 [CNC] (1 male); 9-VII-59 [JNK] (1 male); 10-VII-67 [JNK, CNC] (3 males); 20-VII-65 [JNK] (1 male); 20-VII-67 [JNK] (1 male); 30-VII-59 [JNK] (1 female); Chiricahua Mts., Cochise Co., 29-VI-68, 8,500 ft [CNC] (1 male); 1 mi. S. Portal, Cochise Co., 20-VII-65, 4,800 ft, at light, J. H. and J. M. Davidson, M. A. Cazier [MWS] (1 male); Portal, 23-VII-69, at light, G. H. and J. M. Nelson [CNC] (1 male); Peña Blanca, Pajarito Mts., Santa Cruz Co., 7 & 11-VII-62, Lot. No. 600, R. H. Arnett, Jr., and E. R. Van Tassell [FSCA, CNC] (2 males); same data except 1-VIII-59, Lot No. 439, R. H. Arnett, Jr. [FSCA] (1 male); Cochise Stronghold, Dragoon Mts., 28-VII-64, 4,500 ft, U.V. light, J. Burger [UA, CNC] (3 males); Globe, 8-VIII-49, Werner and Nutting [CNC] (1 male); MEXICO: Baja California: 45 mi. N. San Ignacio, 28-VII-38, Michelbacher and Ross [CAS] (1 male); 15 mi. N. El Refugio, 4-VII-38, Michelbacher and Ross [CAS] (1 female).

I am grateful to Mr. M. W. Stone for permission to retain the holotype and allotype in the Canadian National Collection. The paratypes are distributed as indicated.

Discussion. Adults of *knulli* differ from those of all other species of *Anchastus* by the absence of the lobe on the third tarsal segment. The greatly expanded hind coxal plate, the bicarinate hind angles of the pronotum, the elongate first segment of the hind tarsus, the prominent tibial spurs, and the general habitus all refer this species to *Anchastus*; however, it lacks the lobed third tarsal segment, which is considered to be a key generic character. If one ignored the simple third tarsal segment, there would be no doubt as to which genus to assign this species.

Dr. L. Laurent (pers. comm.) noted that too much emphasis has been placed on the presence or absence of tarsal lobes; he further suggested that this species represented a new subgenus and should be placed near the subgenus *Brachycrepis* LeConte (see Laurent and Taminaux 1961, 1962). However, since the generic characters and limits of *Anchastus* are not well understood, I prefer to ignore subgeneric placement for this species until a thorough revision of the nearctic species is available.

REFERENCES

CAMPBELL, J. M., AND J. D. MARSHALL. 1964. The ocular index and its application to the taxonomy of the Alleculidae (Coleoptera). Coleopt. Bull. 18:42.

LAURENT, L., AND E. TAMINAUX. 1961. Physorhininae de la Region Aethiopienne (Coleoptera, Elateridae). I. Bull. Soc. Roy. Sci. Liége 30:72-90.

LAURENT, L., AND E. TAMINAUX. 1962. *Ibid.* II. 31:113-139.

SCHAAF, D. 1970. Revision of the genus *Physorhinus* (Coleoptera, Elateridae) in North, Central, and South America. Part I: Introduction and key to species. Ent. News 81:225-232.

LITERATURE NOTICE

Galewski, K. 1971. A study on morphobiotic adaptations of European species of the Dystiscidae (Coleoptera). Polskie Pismo Entomologiczne (Bulletin Entomologique de Pologne) 41(3):487-702; 302 fig. In English.

Galewski, K. 1971. [Keys for the identification of Polish insects]. Order XIX, Part 7, Dytiscidae. Polskie Towarzystwo Entomologiczne (Nr. 70 Serii kluczy). In Polish. 112p.; 469 fig.

Warchalowski, Andrzej. 1971. [Keys for the identification of Polish insects]. Order XIX, Part 94a, Chrysomelidae (Donaciinae, Orsodacninae, Criocerinae, Clytrinae, Crypocephalinae, Lamprosomatinae, and Eumolpinae. Polskie Towarzystwo Entomologiczne (Nr. 72 Serii kluczy). In Polish. 113p.; 546 fig.

Although I don't read Polish, a quick perusal of the latter 2 volumes easily shows how far ahead of us the Europeans are in their faunal studies. Most coleopterists are aware of the faunal studies of several countries (e.g. Romania, Germany, Russia, and Switzerland). The present series from Poland is extremely well illustrated (the 2 volumes having over 1000 illustrations). Keys are presented to all the known Polish species, with the discussion of each alongside each couplet (in smaller type). This has the advantage of the full treatment where a specimen keys out, rather than referring to another page for additional details.

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Copies of these publications may be obtained by writing to "Ars Polona", Warszawa, Krakowskie Przedmiescie 7, Poland or to the Library of the Polish Entomological Society, Wroclaw, ul. Cybulskiego 30, Poland.

—R. E. Woodruff

(*continued from inside front cover*)

or counties listed. Dates are listed by day, month (in Roman numerals), and last 2 digits of the year. Listing of ecological data is encouraged. Location of specimens should be shown in brackets; if the data is extensive these should be abbreviated as shown and the abbreviations listed in the text.

Any article concerning Coleoptera will be considered. Descriptions of new taxa must contain keys (or be correlated with existing keys) and illustrations. All manuscripts should be typed on 8½x11" opaque white paper with 1 inch margins. They should be typed on one side only and double spaced throughout (including title, footnotes, tables, figure legends, and references). All scientific names should be underlined. Use the following order: title, author, author's address, abstract, body of text, references cited, and figures. All footnotes, tables, and figure legends should be provided on separate sheets and double spaced. Indicate approximate figure and table locations in pencil in the margin of the manuscript.

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SCARABAEIDAE: Studying myrmecophilous and termitophilous Aphodiinae. Request loan of New World material especially. Will sort from general scarab collections or from light trap samples. Robert E. Woodruff, Fla. Dept. Agr., P. O. Box 1269, Gainesville, FL 32601.

HYDROPHILIDAE: Presently revising the genus **Hydrochus** from North, South, and Central America, including the Antilles. Request loan of any material from the Western Hemisphere. John L. Hellman, Ent. Dept., Univ. Maryland, College Park, MD 20742.

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CERAMBYCIDAE: Longicornes du Laos by Gressitt, Rondon, and Breuning. Pacific Insects Monograph 24, 1970, 651 p., 102 pl. (2 color), maps. Over 1000 species illustrated. $17.50 hard cover; $16.00 paper. Bishop Museum Press, Box 6037, Honolulu, HI 96818.

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SCARABAEIDAE: Working toward a world revision of the Anomalini. Specimens and records needed from all areas, by loan, purchase, or general exchange. Identifications by arrangement, correspondence invited. R. W. L. Potts, California Acad. Sci., Golden Gate Park, San Francisco, CA 94118.

WANTED: One copy of "Catalogue of the Coleoptera of America, north of Mexico" by C. W. Leng, 1920. P. P. Shubeck, Biology Dept., Montclair State College, Upper Montclair, N. J. 07043.

COCCINELLIDAE: North American specimens and locality records of **Coccinella undecimpunctata** L. required for distribution study of this species. M. Y. Watson, Dept. Biology, Laurentian Univ., Sudbury, Ontario, Canada.

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REPRINTS DESIRED: Now working on the interpretation and integration of available evidences on phylogeny in construction of a phylogenetic classification of Coleoptera. Reprints are requested from specialists in all families. Mohammad Abdullah, Zoologische Staatsammlung, 8 Munich 19, W. Germany.

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Specimen label data should be listed in the following manner: MEXICO: State of Veracruz, Fortin de las Flores, 10-VIII-70, I. B. Jones, under bark of **Pinus moctezumae**, 7000ft. [USNM] (2). The number in parentheses indicates the number of specimens. Geographical names are listed in order with largest units first, with states, departments, provinces, parishes, and/

Continued inside back cover

(Mailed under second-class permit at Gainesville, Florida. Postmaster: send form 3579 to editorial office—Dr. R. E. Woodruff, P. O. Box 1269, Gainesville, FL 32601).

THE GENUS *OLIGOTA* MANNERHEIM IN THE CARIBBEAN REGION (COLEOPTERA: STAPHYLINIDAE)

J. H. Frank

Sugar Manufacturers' Association (of Jamaica) Ltd.,
Research Department, Mandeville, Jamaica[1]

Abstract

Descriptions are given for 20 known species and 5 new species of the genus *Oligota* Mannerheim (Col., Staphylinidae) occurring in the Caribbean region and adjacent land areas. A key for identification is provided. The 5 new species are *O. haitiana, O. multicarinata, O. caribae, O. humboldti* and *O. barbadorum. Oligota guadeloupae* is proposed as a new name for *Oligota minutissima* Bernhauer.

Introduction

The generic synonymy of *Oligota* Mannerheim (1831:486) is given by Blackwelder (1952). The subgenus *Holobus* Solier (1849:335) has been treated by recent authors (Coiffait and Saiz 1967, and Seevers manuscript) as of generic rank but this elevation has not been followed here, and the reasons are given below. Individuals of *Oligota* may be differentiated from individuals of other Aleocharinae of the Caribbean region by possession of the following characters: head (including labrum) less than ½ broader than long; antenna 10-segmented, 3 or more terminal articles forming a loose club; mesocoxae widely separated; hind coxa with a lamella over the base of the femur; tarsi 4-segmented, the basal article of the hind tarsus not as long as the 3 following articles together; length less than 1.2 mm.

The genus *Oligota* is of considerable interest because at least some of its members prey on phytophagous mites. The small size of the individuals, together with scattered descriptions of the species in 4 languages (English, German, Latin, Spanish), has made identification of the species of the Caribbean region difficult, especially to economic entomologists who might otherwise be able to provide valuable prey records. The described species of the region are here compared, and a key is given for their identification. Four species, not found in the Caribbean region proper but from neighbouring parts of Central and South America, are included.

The sculpture of the abdominal terga is a useful diagnostic character. These terga (tergum II is the first visible tergum) vary from complete absence of sculpture (pubescence only) to the presence of U- or V-shaped setiferous tubercles varying in size and prominence, and to the presence of distinct longitudinal carinae with their sides parallel or nearly so. These carinae are setiferous and probably of the same origin as the tubercles, but they are continuous with the raised anterior borders of the terga (except, occasionally, in the case of the carina immediately adjacent to the lateral edge of the tergite), which is not so with the tubercles. The number and horizontal spacing of the carinae on the tergum is usually irregular, but their presence or absence appears to be diagnostic at the species level. Fig. 1 to 25 were drawn with the abdomen as found and generally somewhat telescoped, particularly in dried specimens. Although the sculpture of fresh specimens may be seen fairly clearly with a powerful dissecting microscope, it was found preferable to soften dried specimens in alcohol, remove the abdomen, soften this in cold, concentrated KOH, and remove the terga before drawing their sculpture.

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[1] Present address: Entomological Research Center, P. O. Box 520, Vero Beach, FL 32960

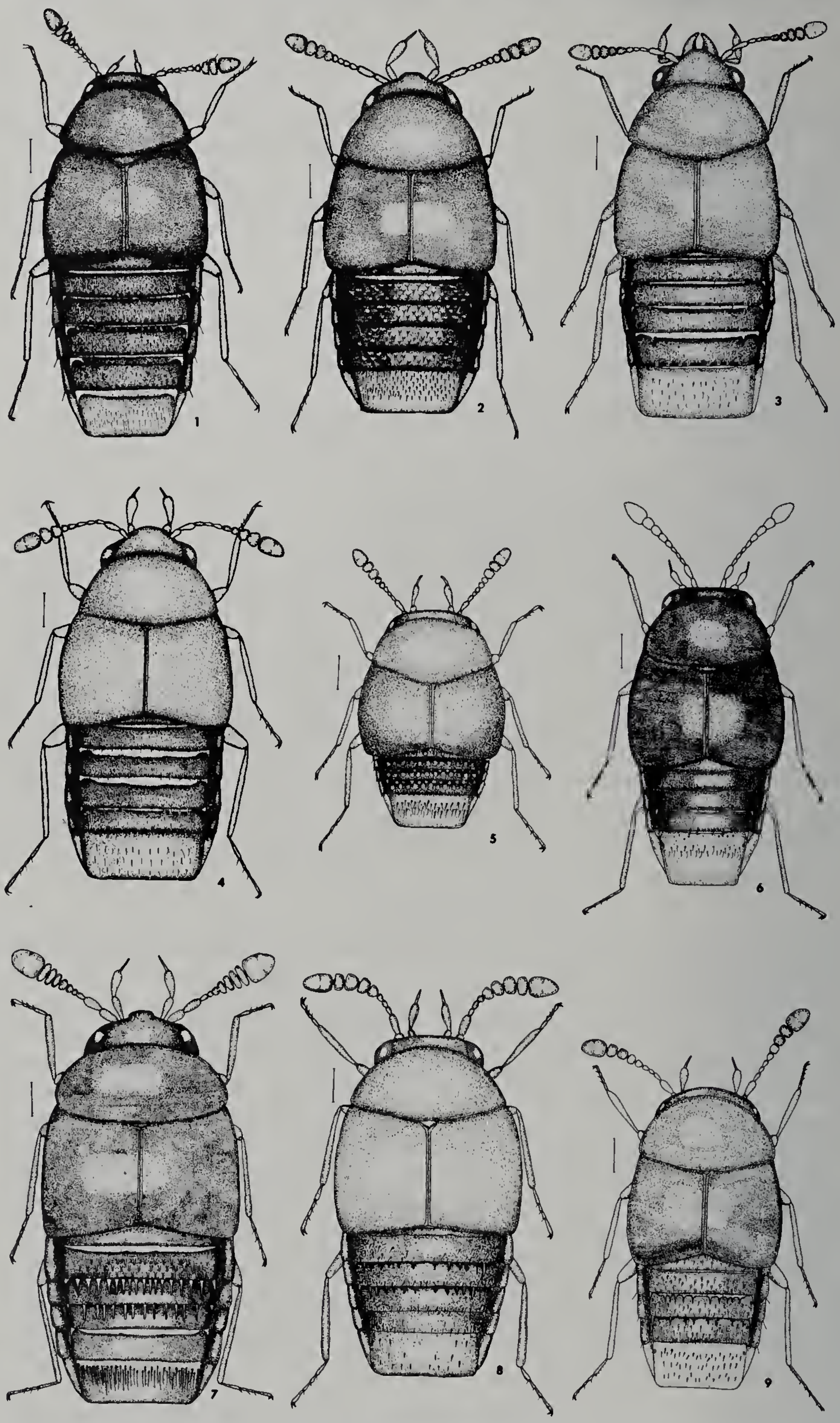

Fig. 1-9: *Oligota* spp.: 1) *O. chrysopyga* Kr.; 2) *O. cadaverina* Brg.; 3) *O. zonata* Brg.; 4) *O. haitiana* sp. nov.; 5) *O. guadeloupae* nomen novum; 6) *O. albidicornis* Bernh.; 7) *O. multicarinata* sp. nov.; 8) *O. caribae* sp. nov.; 9) *O. hypocyptina* Bernh. The scale line represents 0.1 mm.

The genitalia of male specimens may be removed at the same time for examination. Temporary mounts of terga and genitalia were made in glycerol on cavity microscope slides. Permanent mounts were made in Canada balsam (after dehydration) or polyvinyl lactophenol (without dehydration) on standard microscope slides or on small rectangles of celluloid which were pinned along with the specimen. Whole insects, mounted with water-soluble glue on card rectangles, are more easily handled and less liable to damage than specimens mounted on card points.

Because of telescoping in dried specimens, length is not a very useful measurement. It is given here (for uniformity) as the length from the eyes to the apex of abdomen. The head of a live specimen is normally

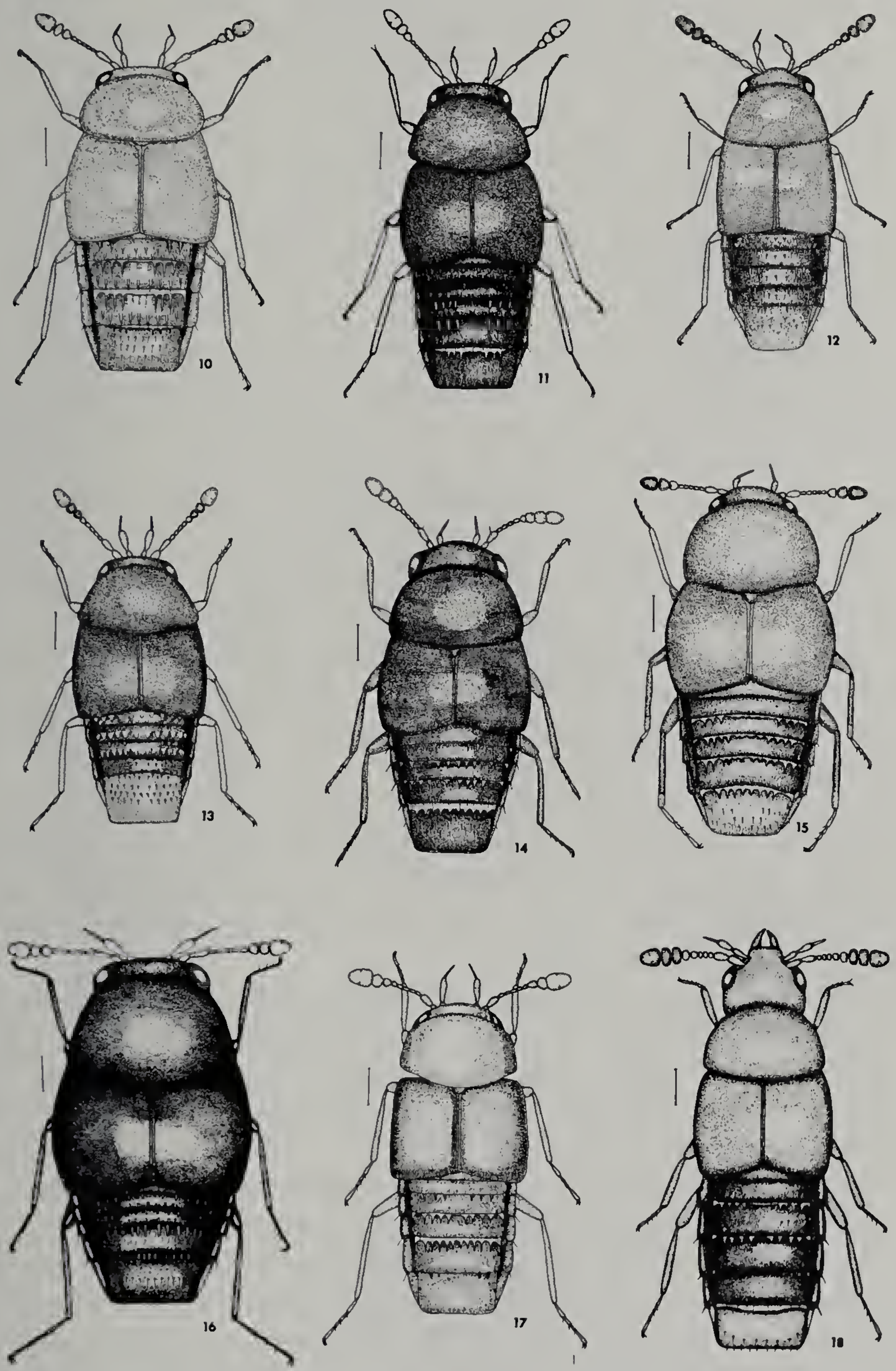

Fig. 10-17: *Oligota* spp.: 10) *O. testaceorufa* Bernh.; 11) *O. laxata* Cam.; 12) *O. humboldti* sp. nov.; 13) *O. smithi* Cam.; 14) *O. minuta* Cam.; 15) *O. barbadorum* sp. nov.; 16) *O. centralis* Sharp; 17) *O. luteicornis* Brg. The scale line represents 0.1 mm.

held in a more or less vertical position so that the mandibles are not visible from above. Characters of the maxillary palpi and antennae are readily seen, but not those of the mandibles, labium, and frons, which require dissection from the head. Width is the maximum width of the elytra.

Coiffait and Saiz (1967) separated the subgenera (which they considered genera) *Oligota* and *Holobus* on the following characters:

1. Smaller body, almost parallel-sided, labrum truncate anteriorly, prementum small and deeply divided into two lobules ...... *Oligota*
1.′ Larger body, strongly narrowed apically, labrum indented at anterior edge (but illustrated as bilobed), prementum with a very small entire lobe with bristles .... *Holobus*

For *Oligota* these characters were based on examination of *Oligota pumilio* Kiesw., *O. apiciventris* Fairm. & Germ. and *O. loana* Coiffait and Saiz; those of *Holobus* were based on *H. pigmaeus* Solier. In addition, the shape of the mandibles (right mandible finely denticulate in *Oligota*, not in *Holobus*) was considered to be a character separating the taxa.

I have examined specimens of *Oligota pusillima* (Gravenhorst) (*Aleochara*), the type species of *Oligota*, and found them to agree in the above characters with Coiffait's definition of that taxon, except that the labrum is very shallowly emarginate rather than truncate. *Holobus pigmaeus* is the type of *Holobus*. These characters, especially those of the labium, are not readily seen, and their examination involves some dissection of the head, almost invariably resulting in its destruction. Thus I have examined these characters in only a few species because I did not wish to risk destruction of borrowed specimens, especially when these were holotypes. Therefore I have not attempted a subgeneric separation of the species I have examined. Characters of the labium and mandibles were examined in specimens of *O. barbadorum*, in Colombian specimens of *O. centralis*, and in Jamaican specimens of *O. minuta*.

In *O. barbadorum* and *O. minuta* the prementum is similar to that of *Holobus pigmaeus* figured by Coiffait and Saiz. The labrum is much less deeply divided than that of *H. pigmaeus* or of *O. centralis*, emarginate rather than bilobed. The right mandible is not denticulate and the body is strongly narrowed posteriorly.

In *O. centralis* the prementum is similar to that of *Holobus pigmaeus* and of *O. barbadorum*, but the articulation between the first and second articles of the labial palpus was not visible in the specimens examined. The labrum is bilobed and the right mandible is not denticulate. The body is narrowed posteriorly.

O. barbadorum, *O. minuta*, and *O. centralis* would thus be placed in *Holobus*, but there is some variation in diagnostic characters. Until an adequate number of specimens of the remaining species is available for dissection, the range of variation of these characters will not be known. I have arranged the species in the following pages according to similarities and expect that the division between the subgenera *Oligota* and *Holobus* occurs in the vicinity of *O. rhopalocera*.

The 3 remaining subgenera (*Deroligota* Sharp (1908:555), *Gnatholigota* Sharp (1908:556), and *Nesoligota* Sharp (1908:557)), do not appear to be represented in the Caribbean area. I have examined specimens (in the case of *Nesoligota* the holotype) of the type species of each of these taxa. The key below does not differ much from that given by Sharp (1908).

KEY TO SUBGENERA OF *Oligota*

1. Mandibles falciform, each with a single tooth at about half the length from the base; gular sutures almost parallel.......... .... *Gnatholigota*

1′. Mandibles short and stout, gular sutures strongly divergent basally 2

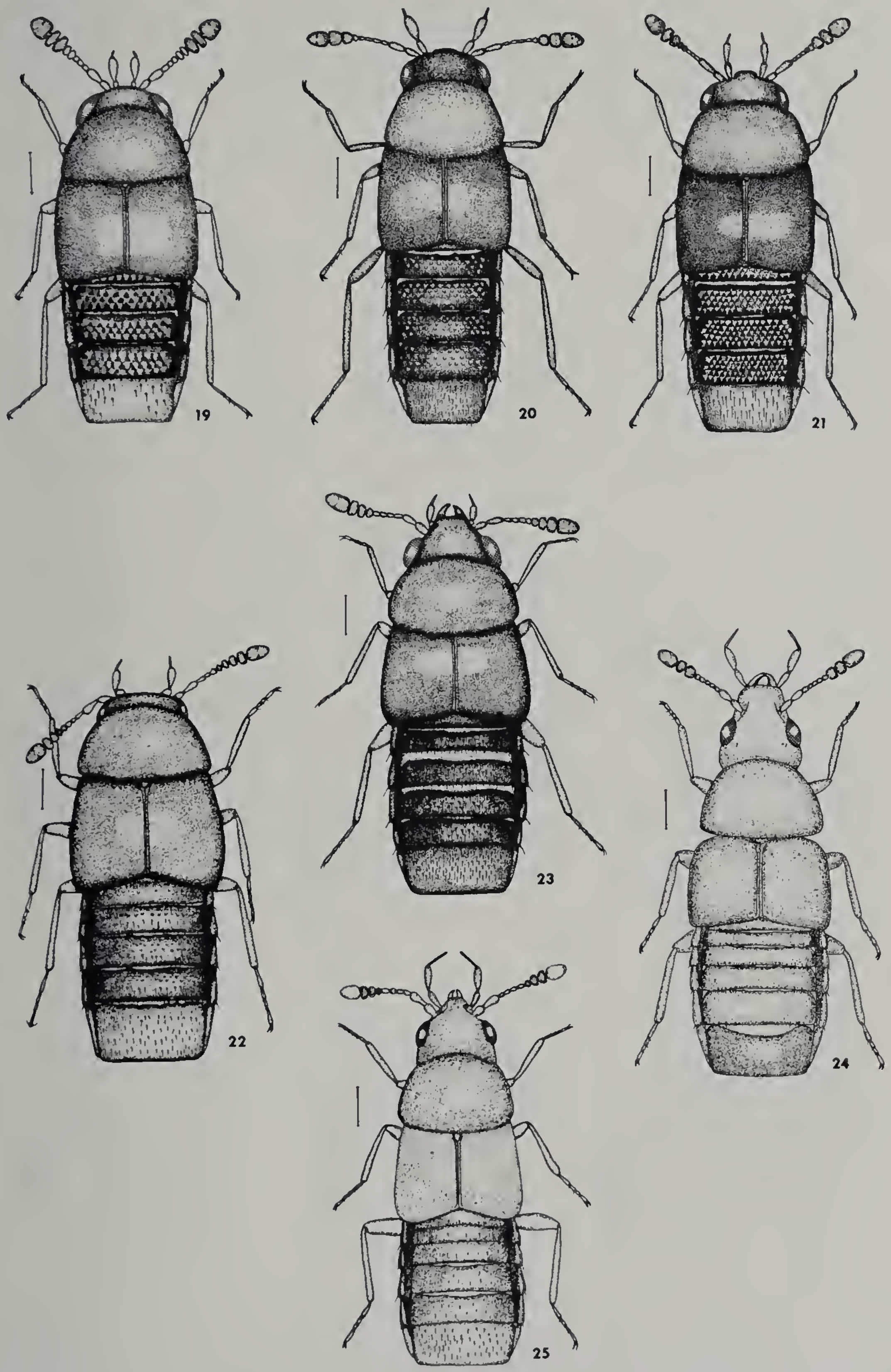

Fig. 18-25: *Oligota* spp.: 18) *O. rhopalocera* Bernh.; 19) *O. tricolor* Brg.; 20) *O. schmidti* Brg.; 21) *O. horni* Brg.; 22) *O. parva* Kr.; 23) *O. pseudoparva* S. A. Williams; 24) *O. rufa* Cam.; 25) *O. maculicornis* Cam. The scale line represents 0.1 mm.

2(1). Length greater than 1.1 mm; abdomen not broadest at base 3
2′. Smaller, if longer than 1.0 mm, then abdomen narrowed from base to apex 4
3(2). Body broad; elytra longer than pronotum .... *Nesoligota*
3′. Body slender; elytra shorter than pronotum; prementum with 2 small lobules .... *Deroligota*
4(2′). Smaller, almost parallel-sided; labrum truncate or slightly and broadly emarginate anteriorly; prementum with 2 tiny lobules .... *Oligota*
4′. Larger, strongly narrowed posteriorly, labrum bilobed or deeply divided; prementum without 2 tiny lobules .... *Holobus*

Collections are abbreviated as follows: British Museum, Natural History (BMNH); Field Museum of Natural History (FMNH); Institute of Jamaica (IJ); J. H. Frank (JHF); S. A. Williams (SAW); University of the West Indies, St. Augustine, Trinidad (UWIT).

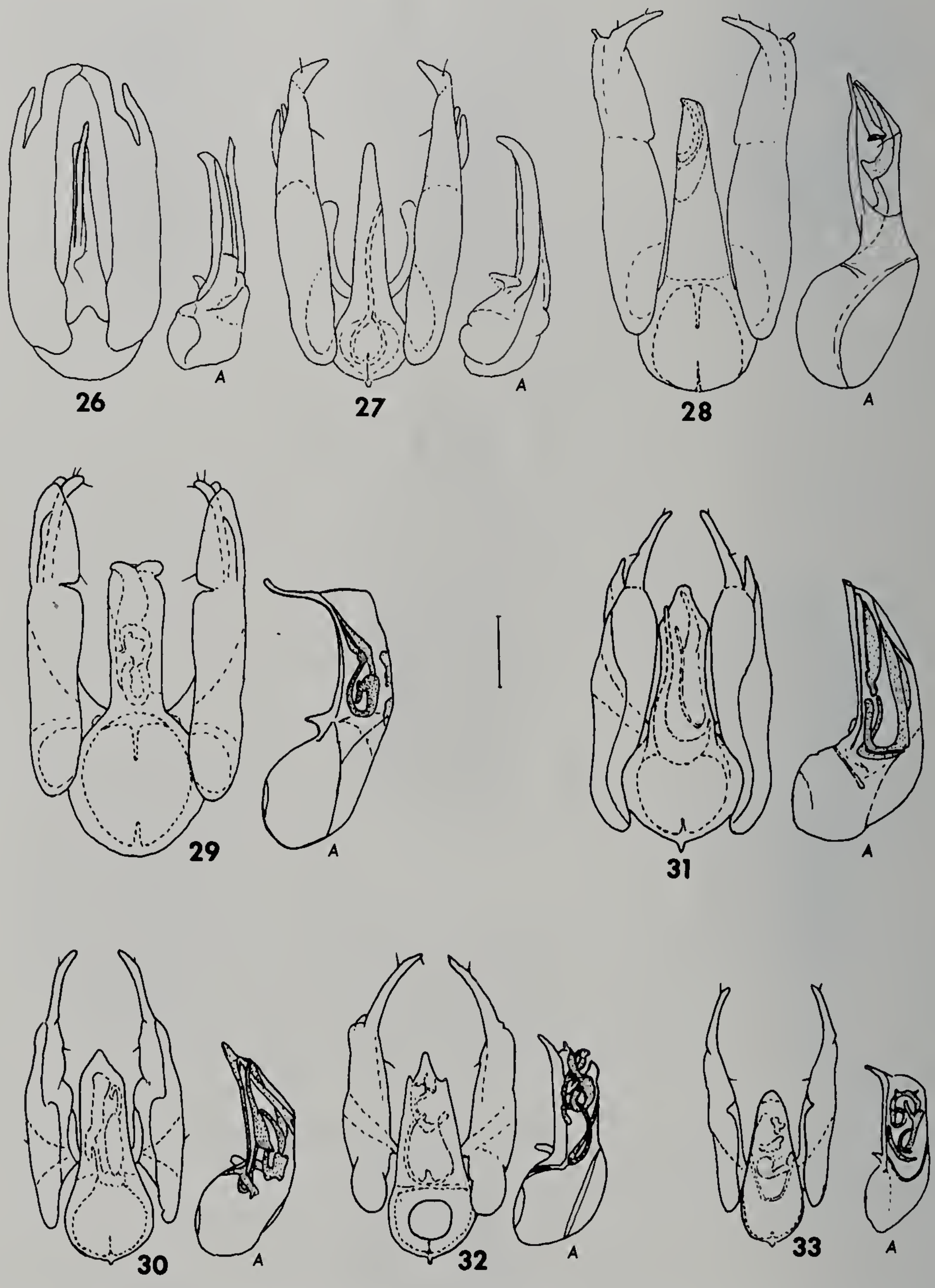

Fig. 26-33: *Oligota* male genitalia: 26,26a) *O. chrysopyga* Kr.; 27,27a) *O. cadaverina* Brg.; 28,28a) *O. zonata* Brg.; 29,29a) *O. haitiana* sp. nov.; 30,30a) *O. albidicornis* Bernh.; 31,31a) *O. multicarinata* sp. nov.; 32,32a) *O. hypocyptina* Bernh.; 33,33a) *O. testaceorufa* Bernh. The scale line represents 0.1 mm.

Description of Species

Oligota chrysopyga Kraatz, 1859:45

(Fig. 1,26,26A,45)

Oligota ventralis Fauvel, 1889:271

Length 1.10 mm, width 0.50 mm. Large, convex, ovate, moderately closely punctate and pubescent. Head, elytra, and terga II-VI fulvopiceous; pronotum fulvous; tergum VII and legs flavescent; articles I-VII of antenna and last article of maxillary palpus flavous, remaining articles fulvous. Articles VII-X of the (short) antenna forming a club; article VII intermediate in width between VI and VIII. Last article of maxillary palpus 1/2 length of penultimate. Elytra longer than pronotum. Terga without longitudinal carinae. Aedeagus slender, curved apically; lateral parameres exceeding length of aedeagus by 1/3. *Type locality*: Ceylon. *Specimens examined*: Grenada: 'Windward Side' (?St. Andrew Parish),

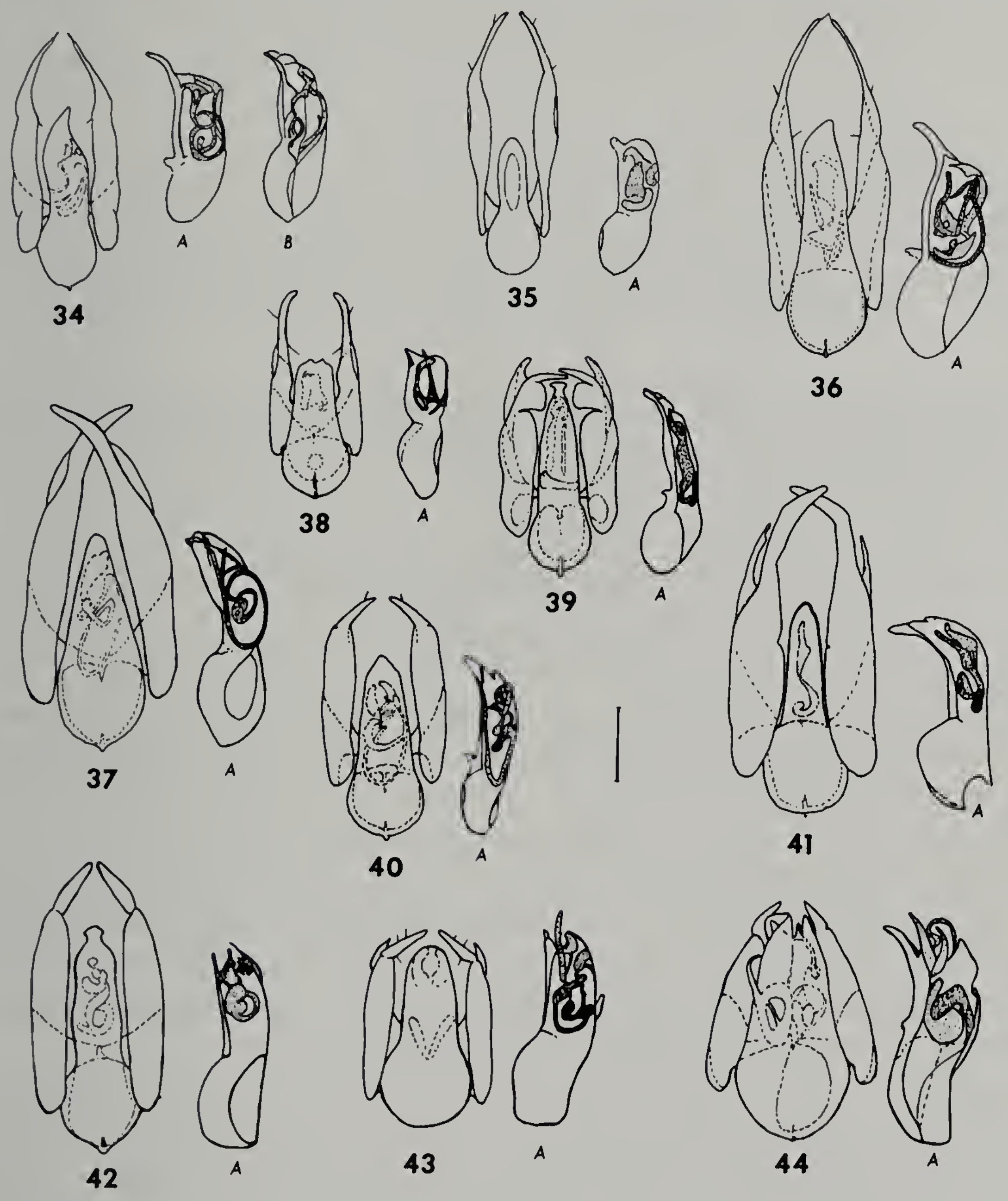

Fig. 34-44: *Oligota* male genitalia: 34,34a,b) *O. minuta* Cam.; 35, 35a) *O. barbadorum* sp. nov.; 36,36a) *O. centralis* Sharp; 37,37a) *O. luteicornis* Brg.; 38,38a) *O. rhopalocera* Bernh.; 39,39a) *O. schmidti* Brg.; 40,40a) *O. horni* Brg.; 41,41a) *O. parva* Kr.; 42,42a) *O. pseudoparva* Williams; 43,43a) *O. rufa* Cam.; 44,44a) *O. maculicornis* Cam. Note: the view of the aedeagus in Fig. 34a is lateral, in Fig. 34b dorso-lateral and everted. The scale line represents 0.1 mm.

Balthazar, H. H. Smith (1: BMNH); **Jamaica**: St. Elizabeth Parish, Galleon Beach, 13-II-72, J. H. Frank, in pile of rotting seaweed (1♂: JHF); Westmorland Parish, Negril, 21-III-72, J. H. Frank u.v. light trap in breadfruit grove (1:JHF). **Canary Islands**: Tenerife, Puerto de la Cruz, 21-23-I-67, T. Palm (1 male: SAW). *Other records*: Africa and Orient (Blackwelder, 1943).

Oligota cadaverina Bierig, 1934:113

(Fig. 2,27,27A,46)

Length 1.10 mm, width 0.50 mm. Large, convex, ovate, moderately closely punctate and pubescent. Head, pronotum, and elytra ferruginous; terga II-VI piceous, VII rufous; legs, palpi and antennae rufous with antennal articles VII-X slightly ferruginous. Antenna longer than that of *O. chrysopyga*, gradually clubbed. Last article of maxillary palpus 0.5 length of penultimate. Elytra longer than pronotum. Terga without longitudinal carinae, but with small tubercles. Aedeagus slender, curved apically, similar to that of *O. chrysopyga*; lateral parameres exceeding length of aedeagus by 1/3.

Type locality: **Cuba**: Havana Province, Mariel. *Specimens examined*: **Cuba**: Havana Province, Mariel, 2-II-30, (lectotype), Playa Marianas, 10-IV-32, (4), Sierra Bonilla, Cueva del Indio, Tapaste, 5-II-35 (1), Havana, 13-V-37 (1) (all FMNH); **Virgin Islands**: Tortola, M. Cameron (4 : BMNH).

Remarks: Bierig (1934) stated that the species is very common in leaf litter; many individuals were found under the very decomposed corpse of a dog along with *O. parva*.

O. zonata Bierig, 1934:115

(Fig. 3,28,28A,47)

Length 1.05 mm, width 0.50 mm. Large, convex, not so much narrowed posteriorly as the 2 preceding species. Elytra with denser punctation than pronotum, pubescence sparse. Head, pronotum, elytra, legs, and palpi ferruginous; terga II-VI picescent; articles VI-IX of antenna infuscate; tergum VII, articles I-V and X of antenna rufous. Antenna gradually clubbed. Last article of maxillary palpus ½ length of penultimate. Elytra longer than pronotum. Terga without longitudinal carinae. Aedeagus broader than that of *O. chrysopyga* and *O. zonata*, sinuate at the apex; lateral parameres exceeding it in length by 0.25.

Type locality: **Cuba**: Havana Province, Sierra Bonilla, *Specimens examined*: **Cuba**: Havana Province, Sierra Bonilla, 15-V-32 (lectotype), III-35 (3), Aspiro-Rangel, 30-III-34 (1), II-36 (1) (all FMNH); **Jamaica**: St. Andrew Parish, Upper Mountain View, 3-XI-46, G. B. Thompson, from decayed sweetsop (*Annona squamosa* L.) (1 : IJ). *Other records*: **Cuba**: Pinar del Rio Province, Portugués, VIII-29; Havana Province, Aspiro, III-34 (Bierig, 1934).

Remarks: Bierig (1934) stated that all 3 specimens seen by him at that time had been collected under wet bark of fallen trees.

O. haitiana Frank, NEW SPECIES

(Fig. 4,29,29A,48)

Length 1.05 mm, width 0.50 mm. Body rounded but abdomen not strongly narrowed posteriorly (as *O. zonata*). Moderately densely punctate and pubescent; not very shining. Head, pronotum, elytra, tergum VII and last article of antenna rufous; legs, palpi and articles I-V of antenna flavo-rufous; articles VI-IX of antenna slightly infuscate; terga II-VI piceo-rufous, but sometimes only V-VI piceo-rufous and remainder rufous. Antennal club formed of articles VII-X, though VII much narrower than VIII so that club is not abrupt; articles VIII and IX not very transverse. Last article of maxillary palpus 0.4 length of penultimate. Elytra much longer than pronotum. Terga without longitudinal carinae. Aedeagus broad, apex very much curved and elongate; lateral parameres exceeding it in length by ¼.

Type locality: HAITI. *Specimens examined*: HAITI: M. Cameron (holotype and 7 paratypes: BMNH).

Oligota guadeloupae Frank, NOMEN NOVUM

(Fig. 5,49)

Oligota minutissima Bernhauer, 1923:144 (not Stephens, 1832:146 and 431; not Heer, 1839:334).

Length 0.70 mm, width 0.45 mm. Small, very broad, rounded, strongly narrowed apically. Body shining, sparsely punctate and pubescent. Head and pronotum castaneous, terga II-VI and elytra (especially apically) infuscate; legs, palpi, antennae and tergum VII flavescent. Antennae gradually clubbed, apical articles not especially transverse. Last article of maxillary palpus ½ length of penultimate and slightly curved. Elytra not much longer than pronotum. Terga without longitudinal carinae, but with faintly-delineated large, flat, V-shaped tubercles. Male unknown.

Type locality: GUADELOUPE. *Specimens examined*: GUADELOUPE: Plason (2 syntype females mounted on same card, the foremost of them is here designated the lectotype: FMNH).

Remarks: *Oligota guadeloupae* is proposed here as a new name for *Oligota minutissima* Bernhauer, 1923, which name is a junior homonym of *Oligota minutissima* Stephens, 1832.

Oligota albidicornis Bernhauer, 1923:143

(Fig. 6,30,30A,50)

Length 0.95 mm, width 0.45 mm. Sides not strongly rounded; strongly narrowed apically. Body shining, sparsely punctate and pubescent. Head, pronotum, elytra and terga II-VI dark, shining piceo-ferruginous; tergum VII rufous; legs flavescent, antennae and palpi very pale flavous. Antenae very gradually clubbed without any transverse articles. Last article of maxillary palpus 0.6 length of penultimate. Elytra much longer than pronotum. Terga without longitudinal carinae. Aedeagus quite broad, lateral parameres exceeding it in length by ½; somewhat resembling *O.*

multicarinata and *O. centralis*.
Type locality: GUADELOUPE. *Specimens examined*: GUADELOUPE: Plason (holotype and paratype male: FMNH).

Oligota multicarinata Frank, NEW SPECIES
(Fig. 7,31,31A,51)

Length 1.15 mm, width 0.60 mm. The largest *Oligota* of the region; broad, not much ovate. Moderately closely punctate and pubescent. Head, pronotum, elytra and abdomen entirely piceo-ferruginous; antennae, palpi and legs ferruginous. Articles VI-IX of antenna increasingly transverse; article IX very strongly transverse, more than 3 times as broad as long; article V quadrate. Last article of maxillary palpus 5/8 length of penultimate. Elytra longer than pronotum which is very transverse. Terga IV and V with strong longitudinal carinae; tergum III with 3 rows of elongate tubercles but without carinae; terga VI and VII without carinae, though VII with numerous strong setae. Aedeagus broad, the lateral parameres exceeding it in length by almost 1/3.
Type locality: CUBA: Pinar del Rio Province, Sierra del Rosario. *Specimens examined*: CUBA: Pinar del Rio Province, Sierra del Rosario, V-37 (holotype and paratype), Havana Province, Aspiro, 28-XII-33 (1), El Rangel, XI-25 (1), 29-XII-33 (1), 4-XII-38 (1) (all FMNH).
Remarks: all specimens are from the Bierig collection and have a label name as above.

Oligota caribae Frank, NEW SPECIES
(Fig. 8,52)

Length 1.10 mm, width 0.55 mm. Large, broad, convex. Moderately closely punctate and pubescent. Head, pronotum, elytra, legs, palpi, articles I-V and X of antenna and tergum VII ferruginous; articles VI-IX of antenna and terga II-VI slightly infuscate. Articles VI-X of antenna forming a gradual club. Last article of maxillary palpus greater than 1/2 length of penultimate. Elytra much longer than pronotum. Terga IV and V with longitudinal carinae; terga III, VI and VII without carinae. Male unknown.
Type locality: CUBA: Havana Province, Sierra Rangel. *Specimens examined*: CUBA: Havana Province, Sierra Rangel, XII-35 (holotype), 14-I-34 (1), 18-I-34 (1), 28-I-34 (1), XII-34 (1), Aspiro, XII-37 (1) (all FMNH).
Remarks: all specimens are from the Bierig collection and have a label name as above.

Oligota hypocyptina Bernhauer, 1923:143
(Fig. 9,32,32A,53)

Length 0.95 mm, width 0.45 mm. Not strongly rounded. Body moderately punctate and pubescent. Head, pronotum, elytra, terga II-VI and basal ½ of tergum VII piceo-ferruginous; apex of tergum VII, legs, palpi and antennal articles I-VI rufous; antennal articles VII-X ferruginous. Antennae gradually clubbed, apical articles not strongly transverse. Last

article of maxillary palpus 0.6 length of penultimate. Elytra longer than pronotum. Terga V and VI with longitudinal carinae, IV and VII without. Aedeagus stout, slightly curved at tip; parameres exceeding it in length by ½; rather similar to that of *O. albidicornis*.
Type locality: GUADELOUPE. *Specimens examined*: GUADELOUPE: Plason (2 syntypes mounted on same card: FMNH).

Oligota testaceorufa Bernhauer, 1923:144
(Fig. 10,33,33A,54)

Length 0.90 mm, width 0.40 mm. Not much rounded. Shining, sparsely punctate and pubescent. Head, pronotum, elytra, legs, palpi and antennae pale castaneous; terga infuscate. Antenna with distinct club of articles VIII-X. Last article of maxillary palpus barely ½ length of penultimate. Elytra longer than pronotum. Terga IV-VII with longitudinal carinae. Aedeagus moderate in width and length, curved at tip, with some similarity to that of *O. hypocyptina*; parameres exceeding it in length by 2/3.
Type locality: VIRGIN ISLANDS: St. Thomas. *Specimens examined*: VIRGIN ISLANDS: St. Thomas, L. v. Eggers, ('cotype' : FMNH).

Oligota laxata Cameron, 1922:124
(Fig. 11,55)

Length 0.85 mm, width 0.40 mm. Body scarcely rounded, shining, sparsely punctate. Head, pronotum, and abdomen rufo-piceous, elytra slightly darker; legs, palpi and antennae flavate. Articles VIII-X of antenna forming a distinct club. Last article of maxillary palpus ½ length of penultimate. Elytra distinctly longer than pronotum., Terga V-VII with longitudinal carinae; IV without. Male unknown.
Type locality: GRENADA: 'Windward Side' (? St. Andrew Parish), Balthazar, H. H. Smith (holotype female); 'Leeward Side', St. George Parish, St. George's, H. H. Smith (1 female) (both BMNH).

Remarks: a specimen in the Cameron collection (BMNH) from Kingston, Jamaica, labelled '*O. laxata*' prompted Blackwelder (1943) to record the species as occurring also in Jamaica. I believe that the Jamaican specimen belongs to *O. minuta* q. v.

Oligota humboldti Frank, NEW SPECIES
(Fig. 12,56)

Length 0.75 mm, width 0.35 mm. Small, body scarcely rounded. Body moderately punctate and pubescent. Head, pronotum, elytra, tergum VII, legs, antennal articles I-VII and palpi rufous; terga II-VI rufo-piceous; antennal articles VIII-X slightly darker than the other articles and forming a club. Last article of maxillary palpus 0.6 length of penultimate. Elytra markedly longer than pronotum. Terga IV-VII with longitudinal carinae; tergum III with a pattern of small tubercles. Male unknown.
Type locality: CUBA: Las Villas Province, Trinidad, El Cubanito. *Specimens examined*: CUBA: Las Villas Province, Trinidad, El Cubanito, XII-35 (holotype female : FMNH).

Remarks: the specimen is from the Bierig collection and has a label name as above.

Oligota smithi Cameron, 1922:124
(Fig. 13,57)

Length 0.80 mm, width 0.35 mm. Small, body slightly rounded, more so than *O. humboldti;* more narrowed apically than *O. humboldti.* Body shining, sparsely punctate and pubescent. Head, pronotum, elytra, and terga II-VI rufo-piceous; legs, palpi, and antennae flavous; tergum VII rufous. Antennae short, articles VIII-X forming a club; the club more abrupt than that of *O. humboldti*; apical articles scarcely transverse. Last article of maxillary palpus 2/3 length of penultimate article. Elytra markedly longer than pronotum. Terga IV-VII with longitudinal carinae. Male unknown.
Type locality: GRENADA: St. George Parish, Woburn. *Specimens examined*: GRENADA: 'South End', St. George Parish, Woburn, H. H. Smith (holotype female: BMNH).

Oligota minuta Cameron, 1931:82
(Fig. 14,34,34A,34B,58)

Length 0.80 mm, width 0.40 mm. Shorter, broader, more rounded and more closely punctate and pubescent than *O. laxata.* Head, pronotum, elytra, and terga II-VII fulvo-piceous; middle and hind legs flavescent; fore legs, antennae, and palpi flavous; pubescence pale. Antennal articles VIII-X forming a club as in *O. smithi*; none of the articles is truly transverse. Last article of maxillary palpus 5/6 length of penultimate. Elytra from scutellum shorter than pronotum. Terga IV-VII with longitudinal carinae. Aedeagus rather slender, more so than that of *O. testaceorufa*, curved at apex, asymmetrical, parameres similar to those of *O. testaceorufa.*
Type locality: TRINIDAD: St. George County, Huevos. *Specimens examined*: TRINIDAD: St. George County, Huevos, F. W. Urich, predaceous on mites on cassava (*Manihot esculenta* Crantz) (3 syntypes: BMNH); ANTIGUA: IX-61, F. D. Bennett, predaceous on tetranychid mites, (1 female: UWIT); JAMAICA: Kingston, Hope River, M. Cameron, sweeping, (1 female: BMNH), Kingston, X-60, F. D. Bennett, predaceous on mites, (3 females: UWIT), Trelawny Parish, Hampden Estate, VII-59, F. D. Bennett, predator of *Oligonychus pratensis* (Banks) (Tetranychidae) on sugar cane (*Saccharum officinarum* L.), (1 female: UWIT), St. Catherine Parish, Spanish Town, Jamaica School of Agriculture, 9-VII-71, F. D. Bennett, with *Tetranychus tumidus* Banks (Tetranychidae) on soybean (*Glycine max* Merr.), (11: JHF); CUBA: Havana Province, Havana, 21-VI-29, (1 female), 2-VII-29, (1 female), 5-VII-29, (1 female); Santiago de las Vegas, 25-V-36, A. R. Otero, on *Cedrela* infested with mites, (2 females) (all FMNH). *Other records*: Bierig (1934) records the habitat (under *O. centralis*) as the underside of bean leaves growing up railings of gardens in Calles 8 and 21, Havana-Vedada, Cuba.

Remarks: I have not seen the specimen from the Cameron collection, labelled as *O. minuta* and collected in Grenada, mentioned by Blackwelder

(1943). The Cameron specimen from Jamaica was labelled as *O. laxata*, and this record is given by Blackwelder (1943). The specimens from Cuba are all from the Bierig collection and were recorded by Bierig (1934) as *O. centralis*; this record is also noted by Blackwelder (1943). The Bennett specimens from Antigua and from Kingston, Jamaica had been tentatively identified by R. D. Pope as *O. minuta*. I am not able to differentiate on external morphology any of the specimens from Antigua, Jamaica, or Cuba, from *O. minuta*; nor (on genitalic structure) the 2 males from Spanish Town, Jamaica from the male syntype from Trinidad.

Oligota barbadorum Frank, NEW SPECIES

(Fig. 15,35,35A,59)

Length 1.0 mm, width 0.45 mm. Not as broad as *O. centralis*, strongly narrowed posteriorly. Body shining, sparsely punctate, and pubescent. Head, pronotum, elytra and terga II-VI castaneous; tergum VII paler; middle and hind legs castaneous with tarsus and apical ¼ of tibia paler; anterior legs, palpi and articles I-IX of antenna flavescent; article X darkly infuscate. Antenna with distinct club of articles VIII-X. Last article of maxillary palpus as long as penultimate. Elytra not much longer than pronotum. Terga IV-VII with longitudinal carinae. Aedeagus small, curved at tip, somewhat similar to that of *O. testaceorufa*; lateral parameres slender, exceeding aedeagus by its own length.

Type locality: BARBADOS: Christchurch Parish, Windsor. *Specimens examined*: BARBADOS, Christchurch Parish, Windsor, 27-I-70, M. M. Alam, predaceous on tetranychid mites on sweet potato (*Ipomea batatas* Lam.), (holotype and 6 paratypes); St. James Parish, 4-III-70, M. M. Alam, feeding on tingids on cassava (*Manihot esculenta*) (6); Graeme Hall, 19-II-70, M. M. Alam, on beans (*Phaseolus* sp.) infested with tetranychid mites (5) (all JHF).

Oligota centralis Sharp, 1883:293

(Fig. 16,36,36A,60)

Length 1.0 mm, width 0.55 mm. Very broad, ovate, posteriorly narrowed. Shining, sparsely punctate, and pubescent. Head, pronotum, elytra, and abdomen entirely nigro-piceous, with outstanding setae of the same colour; legs flavous but very darkly infuscate; antennae and palpi flavous. Antenna with a club of articles VIII-X. Last article of maxillary palpus 0.9 length of penultimate. Terga IV-VII with strong, longitudinal carinae. Aedeagus rather similar to that of *O. albidicornis*, but curved at tip, asymmetrical, and lateral parameres more slender.

Type locality: GUATEMALA: Guatemala City. *Specimens examined*: GUATEMALA: Guatemala City, G. C. Champion (holotype female: BMNH); COLOMBIA: (? Guajira Province), San Antonio, 26-VIII-70, I. Zenner de Polania, predator of mites (*Tetranychus cinnebarinus* (Boisd.)) on rose leaf (*Rosa* sp.) (7: JHF). *Other records*: see remarks under *O. minuta*.

Remarks: this is the only species examined in which the body has no trace of reddish colouration.

Oligota luteicornis Bierig, 1934:119
(Fig. 17,37,37A,61)

Length 0.95 mm, width 0.40 mm. Body parallel-sided, not much narrowed apically. Sparsely punctate and pubescent. Head and pronotum rufo-ferruginous; elytra and abdomen unicolorous ferruginous; antennae, palpi, and legs flavescent. Antenna with articles VIII-X forming a distinct club. Last article of maxillary palpus 0.7 length of penultimate. Elytra much longer than pronotum. Terga IV-VII with longitudinal carinae. Aedeagus conical, apex curved, parameres exceeding it in length by 2/3.

Type locality: CUBA: Havana Province, Mariel. *Specimens examined*: CUBA: Havana Province, Mariel, 17-I-32, (lectotype); Aspiro-Rangel, 6-V-34, (1); Havana, 13-V-37 (1), 27-I-38 (1); Sierra de Candela, Güines, 11-XII-38, A. Bierig, (2); Pinar del Rio Province, Sierra del Rosario, V-37, (1) (all FMNH). *Other records*: CUBA: Havana Province, Cruz de Piedra, II-32; La Lisa, I-34; Aspiro, III-34; (? Camaguey Province), Caimito del Guayabal, V-33 (Bierig, 1934).

Remarks: all specimens are from the Bierig collection. Bierig (1934) stated that the species was found by sifting fallen leaves, principally bamboo.

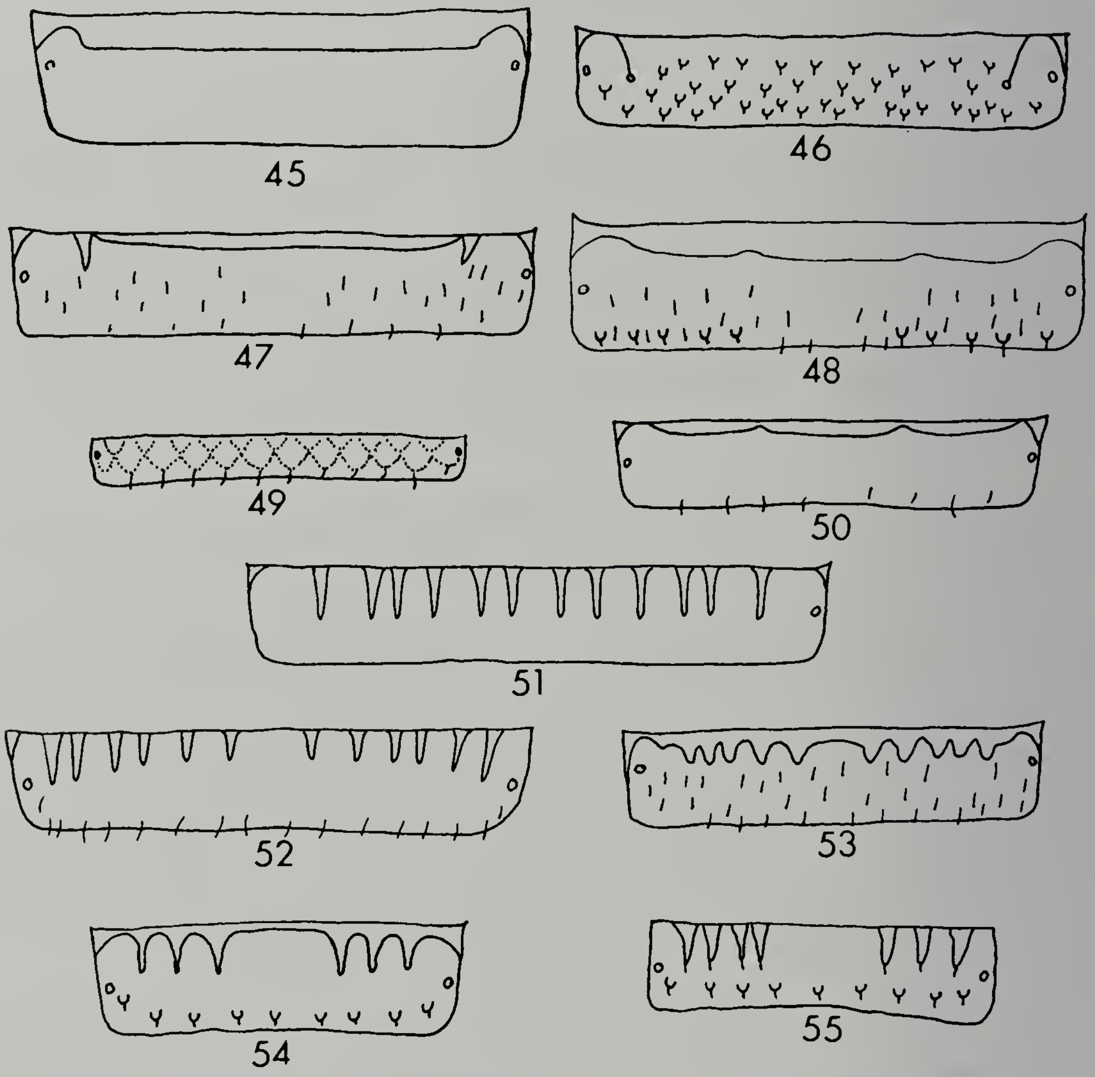

Fig. 45-55: *Oligota* spp., microsculpture on 5th abdominal terga (sometimes partly obscured by 4th): 45) *O. chrysopyga* Kr.; 46) *O. cadaverina* Brg.; 47) *O. zonata* Brg.; 48) *O. haitiana* sp. nov; 49) *O. guadeloupae* nomen novum; 50) *O. albidicornis* Bernh.; 51) *O. multicarinata* sp. nov.; 52) *O. caribae* sp nov.; 53) *O. hypocyptina* Bernh.; 54) *O. testaceorufa* Bernh.; 55) *O. laxata* Cam.

Oligota rhopalocera Bernhauer, 1923:145
(Fig. 18,38,38A,62)

Length 1.05 mm, width 0.40 mm. Parallel-sided, not much narrowed posteriorly, sparsely punctate. Head, pronotum, elytra, legs, and articles I-VII of antenna rufous; tergum VII and maxillary palpi flavescent; terga II-VI and articles VIII-X of antenna ferruginous; darker in colour than *O. testaceorufa*. Articles VII-X of antenna forming a club, though article VII, whilst sharply broader than article VI, is distinctly narrower than article VIII; articles VIII and IX transverse; article VI quadrate; article VII slightly transverse. Last article of maxillary palpus 0.9 length of penultimate. Elytra much longer than pronotum. Terga IV-VI with longitudinal carinae, VII without. Aedeagus very short and broad, curved at the apex; parameres slender and exceeding it in length by ½.

Type locality: Virgin Islands, St. Thomas. *Specimens examined*: Virgin Islands, St. Thomas, L. v. Eggers ('cotype' and 1 male); Cuba: Havana Province, Sierra Bonilla, III-35 (2); Cueva del Indio, Tapaste, 5-II-33 (1); Sierra Rangel, 32 (1), XII-35 (1); Sierra de Candela, Güines, 2-XII-38, A. Bierig (1) (all FMNH); Jamaica: St. Andrew Parish, Clydesdale, 9-III-72, J. H. Frank, under bark of conifer log, (1 female: JHF). *Other records*: Cuba: Havana Province, Sierra Bonilla, Cueva del Indio, 29, Cruz de Piedra, 32 (Bierig, 1934).

Remarks: all the Cuban specimens are from the Bierig collection. Bierig (1934) stated that the species had been found on various occasions, always on sifting fallen leaves in damp sites.

Oligota tricolor Bierig, 1934:116
(Fig. 19,63)

Length 0.90 mm, width 0.35 mm. Body parallel-sided. Punctation and pubescence sparse. Head, pronotum, elytra, and articles VIII-X of antenna fusco-ferruginous; terga II-VI rufo-piceous; tergum VII, articles I-VII of antenna, legs, and palpi bright rufous. Articles VIII-X of antenna form an abrupt club; articles VIII and IX more transverse than in *O. horni*. Last article of maxillary palpus only 1/3 length of penultimate. Eyes large and protruding. Elytra not much longer than pronotum. Terga II-VI without carinae, but with large V-shaped tubercles. Male unknown.

Type locality: Cuba: Havana Province, Guanabo. *Specimens examined*: Cuba: Havana Province, Guanabo, II-31 (holotype female: FMNH).

Remarks: Bierig (1934) stated that the holotype was collected during twilight, in a car.

Oligota schmidti Bierig, 1934:116
(Fig. 20,39,39A,64)

Length 0.95 mm, width 0.35 mm. Parallel-sided. Like *O. parva* in appearance, but smaller and more slender. Finely punctate and pubescent. Head, elytra, terga II-VI and antennal articles VIII-X fusco-ferruginous; pronotum, legs and tergum VII ferruginous; palpi and articles I-VII of antenna rufous. Antennal articles VIII-X forming a club; article VIII

obconical; article IX slightly transverse. Last article of maxillary palpus 0.35 length of penultimate. Elytra distinctly longer than pronotum. Terga without longitudinal carinae but III-VI with a tuberculate sculpture similar to that of *O. parva.* Aedeagus slender; apex with a transverse process; parameres exceeding it by only 1/7 of its length.
Type locality: Costa Rica: San José Province, San José, La Caja. *Specimens examined*: Costa Rica: San José Province, San José, La Caja, 31, H. Schmidt, (holotype); 39, H. Schmidt (1); 41, H. Schmidt (2); 43, H. Schmidt (2); Heredia Province, Vara Blanca (1) (all FMNH).

Oligota horni Bierig, 1934:117

(Fig. 21,40,40A)

Length 0.90 mm, width 0.35 mm. Body parallel-sided, less rounded than *O. tricolor*, more so than *O. schmidti*; hardly narrowed apically. Head, pronotum, and articles VI-IX of antennae ferruginous; elytra, terga II-VI, and article X of antenna infuscate; tergum VII, legs, palpi, and articles I-V of antenna rufescent. Antennal club of articles VIII-X fairly abrupt. Last article of maxillary palpus 0.5 length of penultimate. Elytra much longer than pronotum. Terga without longitudinal carinae, though terga III-VI with a pattern of small tubercles. Aedeagus broad, apical third curved; lateral parameres exceeding it in length by 2/5.
Type locality: Costa Rica: San José Province, San José, La Caja. *Specimens examined*: Costa Rica: San José, La Caja, 31, H. Schmidt (paratype male); VI-43, H. Schmidt (1); 43, H. Schmidt (1) (all FMNH).

Oligota parva Kraatz, 1862:300

(Fig. 22,41,41A,65)

Oligota pygmaea Kraatz, 1858:352 (not *Holobus pigmaeus* Solier, 1849: 336); *Oligota parva* Kraatz, 1862:300; *Oligota contempta* Wollaston, 1867:231; *Oligota aliena* Mulsant and Rey, 1873:134; *Oligota californica* Casey, 1911:230; *Oligota congruens* Casey, 1911:230; *Oligota esmeraldae* Casey, 1911:231.

Length 1.0 mm, width 0.40 mm. Body parallel-sided, not much narrowed apically. Moderately closely punctate and pubescent. Head, pronotum, elytra, and articles VI-X of antenna ferruginous; terga II-VI infuscate; tergum VII, legs, antennal articles I-V, and palpi flavescent. Articles VII-X of antenna forming a club which is not sharply defined. Last article of maxillary palpus 0.5 length of penultimate. Elytra much longer than pronotum. Terga without longitudinal carinae but with a pattern of small tubercles. Aedeagus moderately broad, curved in a broad arc, parameres exceeding it in length by 0.6.
Type locality: France: Rouen (Horion, 1967). *Specimens examined:* Mexico: State of Veracruz, Cordoba, A. Fenyes (1); Virgin Islands: Tortola, M. Cameron (1) (both: BMNH); Jamaica: St. Thomas Parish, Golden Grove, 9-10-IX-69, J. H. Frank, u.v. light trap (1: JHF); St. Catherine Parish, Worthy Park, 13-V-69, R. E. Woodruff, u.v. light trap (1: JHF); *Other records*: Cuba: Havana Province, under the very decomposed corpse of a dog (Bierig, 1934); Jamaica; St. Vincent; Grenada (Cameron collection: Blackwelder, 1943); Mexico; Argentina; U. S. A.; Europe; Orient (Blackwelder, 1943; Horion, 1967 etc.).

Oligota pseudoparva S. A. Williams, 1972
(Fig. 23,42,42A,66)

Length 0.95 mm, width 0.50 mm. Shape similar to that of *O. parva.* Body finely but moderately closely punctate and pubescent. Head, pronotum, elytra, and articles VII-X of antenna ferruginous, slightly flavescent; legs, palpi, and articles I-VI of antenna flavescent; terga II-VI piceo-ferruginous; tergum VII coloured as elytra. Antenna with club of articles VII-X, not sharply defined; articles VIII and IX strongly transverse. Last article of maxillary palpus 0.75 length of penultimate. Elytra scarcely longer than pronotum. Terga without longitudinal carinae but with a pattern of tubercles; the tubercles similar to, but smaller than those of *O. parva* and *O. schmidti.* Aedeagus moderately broad, with a transverse process at the apex like that of *O. schmidti*; lateral parameres exceeding it in length by scarcely 1/3.
Type locality: ENGLAND: Port of Liverpool. *Specimens examined*: ENGLAND: Liverpool, IV-31 (1); 25-X-58 (1) from Brazil nut detritus (both SAW).

Remarks: the species is believed to originate from Brazil (Williams, 1972) and is included here because of its resemblance to *O. parva* and the possible risk of confusion if it should occur in the Caribbean region.

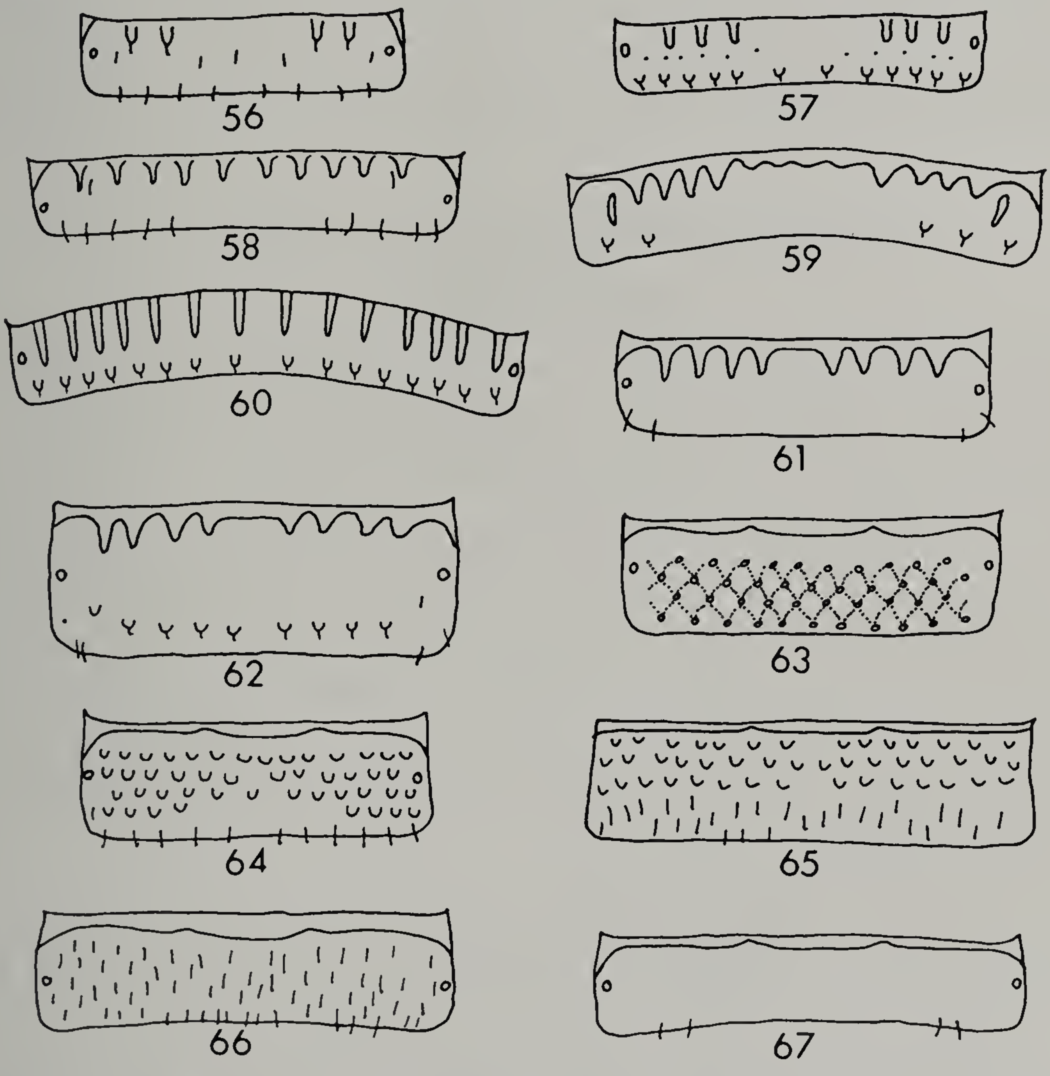

Fig. 56-67: *Oligota* spp., microsculpture on 5th abdominal terga (sometimes partly obscured by 4th): 56) *O. humboldti* sp nov.; 57) *O. smithi* Cam.; 58) *O. minuta* Cam.; 59) *O. barbadorum* sp. nov.; 60) *O. centralis* Sharp; 61) *O. luteicornis* Brg.; 62) *O. rhopalocera* Bernh.; 63) *O. tricolor* Brg.; 64) *O. schmidti* Brg.; 65) *O. parva* Kr.; 66) *O. pseudoparva* Williams; 67) *O. rufa* Cam.

Oligota rufa Cameron, 1922:125

(Fig. 24,43,43A,67)

Length 1.0 mm, width 0.30 mm. Body parallel-sided, slender. Sparsely punctate and pubescent. Head, pronotum, elytra, abdomen, legsl palpi, and articles I-II of antenna rufous; articles III-X of antenna infuscate; tergum VII slightly infuscate. Antenna with distinct club of articles VIII-X; article VII quadrate but distinctly smaller; articles III-VI elongate. Last article of maxillary palpus 0.85 length of penultimate. Elytra from scutellum shorter than pronotum. Terga without longitudinal carinae. Aedeagus broad with short lateral parameres, barely exceeding it in length.

Type locality: JAMAICA; St. Andrew Parish, Constant Spring. *Specimens examined*: JAMAICA; St. Andrew Parish, Constant Spring, M. Cameron, under bark (holotype male: BMNH).

Remarks: Cameron (1922) described the holotype as from St. Lucia. However, the holotype bears the following labels: JAMAICA Dr. Cameron/ Constant Spring under bark./ Type H. T./M. Cameron Bequest. B. M. 1955-147/Standing in B. M. coll. as *O. rufa* Cam. (St. Lucia). Because this is the only specimen in the Cameron collection, its identity as the holotype can hardly be disputed. Since Constant Spring is a well-known locality in St. Andrew Parish, Jamaica, the placement of the specimen in a collection of insects from St. Lucia may have been made accidentally by Cameron, perhaps in comparing it with some other insect. Thus the type locality given by Cameron must be corrected and the St. Lucia record deleted.

Oligota maculicornis Cameron, 1922:124

(Fig. 25,44,44A)

Length 0.90 mm, width 0.30 mm. Body parallel-sided, similar to *O. rufa* but slightly shorter. Quite closely punctate and pubescent. Head, pronotum, and terga II-VI rufous; elytra and tergum VII flavescent; legs and articles I-VI of antenna flavescent; article X of antenna and last article of maxillary palpus flavous; articles VII-IX of antenna and remaining articles of maxillary palpus infuscate. Antenna with distinct club of articles VIII-X; article VII quadrate but distinctly smaller; articles III-VI elongate. Last article of maxillary palpus 0.85 length of penultimate. Elytra from scutellum shorter than pronotum. Terga without longitudinal carinae. Aedeagus broad with short lateral parameres, barely exceeding it in length.

Type locality: HAITI: Port-au-Prince.

Specimens examined: HAITI: Port-au-Prince, M. Cameron, dead tree (holotype male: BMNH; ? paratype: FMNH); CUBA: Pinar del Rio Province, Sierra del Rosario, El Sabicu, IX-36 (2); Havana Province, Pico Somorrostro, 7-XII-29, A. Bierig (2); Aspiro, 1-3-VIII-41, M. Barro (1 male and 2 females); Sierra de Anafe, III-30, P. Bermudez (1) (all FMNH).

Remarks: this species is very closely related to the preceding and is separated on distribution of pubescence, colour, and the form and size of the aedeagus (Fig. 45-46A). The precise relationship to other *Oligota* is not readily apparent and will demand examination of mandibles, labrum, and labium. Bierig (1934) recorded the presence of *O. maculicornis* in Cuba and stated that it is found in fungi and rotten logs. I agree with Bierig's determination of the Cuban specimens.

KEY TO SPECIES OF *OLIGOTA* FROM THE CARIBBEAN REGION

1. Body broad, ovate 2

1′. Body parallel-sided 18

2(1). Tergites unsculptured or with scaly pattern of setiferous tubercles 3

2′. Tergites with several distinct longitudinal carinae 8

3(2). Penultimate article of antenna transverse 4

3′. Penultimate article of antenna slightly elongate .... *albidicornis*

4(3). Length 1.0 mm or more 5

4′. Length 0.7 mm .... *guadeloupae*

5(4). Raised anterior border of terga V and VI entire and without diagonal line 6

5′. Raised anterior border of terga V and VI broken by raised diagonal line 7

6(5). Raised anterior border of terga straight; abdomen more narrowed apically; apex of aedeagus slightly curved .... *chrysopyga*

6′. Raised anterior borders of terga bi-indentate about centre; abdomen less narrowed apically; apex of aedeagus greatly produced and curved .... *haitiana*

7(5′). Terga III-VI with setiferous tubercles .... *cadaverina*

7′. Terga III-VI without setiferous tubercles but with setae .... *zonata*

8(2′). Tergum VI without longitudinal carinae 9

8′. Tergum VI with longitudinal carinae 10

9(8). Penultimate article of antenna more than thrice as broad as long .... *multicarinata*

9′. Penultimate article of antenna less than twice as broad as long .... *caribae*

10(8′). Tergum VII without longitudinal carinae .... *hypocyptina*

10′. Tergum VII with longitudinal carinae 11

11(10′). Tergum IV without longitudinal carinae .... *laxata*

11′. Terga IV-VII with longitudinal carinae 12

12(11′). Head, pronotum, elytra, and abdomen entirely nigropiceous, without any trace of reddish colouration .... *centralis*

12′. Head, pronotum, elytra, and abdomen not nigro-piceous 13

13(12′) Last article of antenna distinctly darker than penultimate .... *barbadorum*

13′. Last article of antenna not darker than penultimate 14

14(13′) Head, pronotum, and elytra rufous, rufo-ferruginous, or pale castaneous 15

14′. Head, pronotum, and elytra rufo-piceous or fulvo-piceous 17

15(14′) Club of antenna darker than basal articles; tergum VII rufous with basal terga dark; length 0.75 mm. ...... *humboldti*

15′. Antenna unicolorous; abdomen unicolorous; length 0.90-0.95 mm. 16

16. Body parallel-sided; last article of maxillary palpus 0.7 length of penultimate .... *luteicornis*

16′. Body more narrowed apically; last article of maxillary palpus barely ½ length of penultimate .... *testaceorufa*

17(14′) Elytra from scutellum longer than pronotum; tergum VII bright rufous .... *smithi*

17′. Elytra from scutellum shorter than pronotum; abdomen unicolorous .... *minuta*

18(1′) Terga with longitudinal carinae 19

18′. Terga without longitudinal carinae 20

19(18). Terga IV-VI only with longitudinal carinae .... *rhopalocera*

19′ Terga V-VI only, V-VII only, or IV-VII with longitudinal carinae .... couplet 10, 10′

20(18′). Elytra from scutellum shorter than pronotum; head, thorax, elytra, and abdomen rufous to flavo-rufous 25

20′. Elytra from scutellum longer than pronotum; head, thorax, and elytra ferruginous or darker, basal abdominal segments darker 21

21(20′). Last article of maxillary palpus about ⅓ length of penultimate 22

21′. Last article of maxillary palpus at least ½ length of penultimate 22

22(21). Penultimate article of antenna 2½ times as broad as long .... *tricolor*

22′. Penultimate article of antenna scarcely broader than long .... *schmidti*

23(21′). Lateral edges of elytra sub-parallel .... *horni*

23′. Lateral edges of elytra strongly curved, elytra broadest in apical ½ 24

24(23′). Last article of maxillary palpus ½ length of penultimate .... *parva*

24.′ Last article of maxillary palpus ¾ length of penultimate .... *pseudoparva*

25(20) Entire body very sparsely punctate and pubescent; tergum VII darker than basal terga .... *rufa*

25′. Much more densely punctate and pubescent; tergum VII paler than basal terga .... *maculicornis*

Discussion

Distribution of species among the Caribbean islands is as follows: Cuba (11), Jamaica (5), Haiti (2), Virgin Islands (4), Antigua (1), Guadeloupe (3), Barbados (1), St. Vincent (1), Grenada (4), Trinidad (1). This probably reflects the activities of collectors, particularly of Bierig in Cuba.

Deposition of Specimens

The holotype and a paratype of *O. barbadorum* have been deposited in the British Museum (Natural History) [BMNH] with paratypes to the Field Museum [FMNH] and specimens to S. A. Williams [SAW]. Colombian specimens of *O. centralis* have been given to BMNH, FMNH, and SAW and Jamaican specimens of *O. minuta* have been given to BMNH, FMNH, SAW, and the Institute of Jamaica.

Acknowledgements

I am deeply indebted to Rupert Wenzel of the Field Museum of Natural History and to Joy Farradane and Peter M. Hammond of the British Museum (Natural History) for the loan of many specimens. Specimens of *O. pseudoparva*, *O. pusillima*, and *O. chrysopyga* were kindly provided by S. A. Williams with whom I also had useful correspondence. F. D. Bennett, T. H. Farr, and R. E. Woodruff kindly provided specimens. G. E. Ball, D. R. Whitehead, and J. M. Campbell obliged by reading and criticising the manuscript.

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BOOK REVIEW

Washington State Place Names by James W. Phillips. 1971. University of Washington Press, Seattle, WA 98105. xv+167 p.; $6.95, cloth.

Entomologists are searching constantly for aids in locating obscure localities on specimen labels. It is unfortunate that few thorough gazeteers are available. This book, although not a gazeteer, will be of great help in tracing the history of various localities and their names in Washington State. It is unfortunate that the author did not include the elevation or the exact location in the form of longitude and latitude. It includes 1500 place names, including major population centers, mountains, rivers, and geographical features. Produced by the same University Press that published Hatch's "Beetles of the Pacific Northwest", it should be useful to anyone dealing with the fauna of that area.—R. E. Woodruff.

NOTES ON DISTRIBUTION AND A PECULIAR BEHAVIOR PATTERN IN *NEBRIA PURPURATA* LECONTE (COLEOPTERA: CARABIDAE).[1]

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Abstract

In a population of *Nebria purpurata* LeC. in the Sangre de Cristo Range, New Mexico, we observed differences in nocturnal behavior between copulating pairs and uncoupled individual adults. Copulating pairs were found on emergent rocks in a stream and were seen entering the water and swimming on the surface. Uncoupled individuals were observed only on the stream bank.

Nebria purpurata LeConte is a carabid beetle known from several ranges in the Rocky Mountain system in Colorado (Erwin and Ball, in press) where it is virtually restricted to Alpine and Subalpine (Marr, 1967) life zones. Hatch (1939, 1953) and Lindroth (1961) listed records for *N. purpurata* from Idaho and Montana (state records only); but these records are instead based on large specimens of *N. gebleri* Dejean.

While collecting in the Sangre de Cristo Range of northeastern New Mexico on June 11, 1971, we observed an interesting and unexpected type of behavior in adult *N. purpurata.* The locality data is as follows: New Mexico, Taos County, Sangre de Cristo Range, 2.2 miles west of Red River P. O., June Bug Campground, Red River, elevation: 8550 feet, 11-VI-71. This constitutes the first record in New Mexico as well as the first verified record for the species outside of Colorado. This locality is in the Upper Montane zone (Marr, 1967), where the dominant tree species are *Picea engelmannii, Pseudotsuga menziesii,* and *Pinus ponderosa.* Streamside dominants include species of *Salix, Alnus,* and *Populus.* We failed to find additional specimens upstream in Alpine and Subalpine zones. This suggests that ecological differences may exist between this population and those in Colorado. The taxonomic significance of this situation will be evaluated in conjunction with a major revision of the genus *Nebria* now in progress (D. H. K.).

First collections in the area were made in daylight at about 7:30 p.m. Specimens of *N. purpurata* were found under small rocks along the rocky banks of the river on wet sand. The river was approximately 20 feet wide at this point and up to 3 feet deep. Water temperature 12 inches from shore and at a depth of 6 inches was 11°C; air temperature at waist height was 16°C.

To obtain a larger series of these nocturnal beetles, we returned to the locality and collected on an adjacent section of river bank between 11:30 p.m. and 1:00 a.m. using flashlights. Water and air temperatures (at same positions as above) were, respectively, 5°C and 8°C. Immediately upon reaching the collecting site, we observed a pair of *N. purpurata* adults *in copulo*, sitting on a small, emergent rock about 4 feet from shore. The beetles were disturbed by the flashlight and immediately raced into the water, still in tandem. Several additional copulating pairs were observed within the next few minutes, each sitting motionlessly on emergent rocks well into the stream. Two more copulating pairs were seen on the bank itself. One pair was moving along the bank parallel to the stream, about 3 inches back from the water. The second pair was discovered just as it entered the water, while maintaining the copulating position. We dimmed the flashlights in an attempt to reduce their disturbing effect and were able to follow the progress of these beetles on the surface of the stream for some distance before we lost sight of them in the ripples. This pair was able to navigate in the swift current, move across the current, and even remain in the same spot (in line with a fixed point on shore) on the surface without being displaced downstream. We observed surprisingly few swimming movements during execution of these maneuvers.

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[2] We thank Drs. B. S. Heming and D. R. Whitehead for their helpful criticism of the manuscript.

We found several uncoupled individuals moving on the bank, generally parallel to the stream margin; but none were seen entering the water, on the water surface, or on emergent rocks in the stream.

Individuals of *N. purpurata* have markedly reduced wing apices and are, therefore, incapable of flight. The copulating pairs described above could have reached the small rock "islands" only on or in the water. While no pair was actually seen reaching and boarding a rock in the stream, observations of the pair seen entering the stream and navigating on its surface suggest: 1) that other pairs reached the rocks via the water surface, and 2) that these pairs made their crossings in tandem rather than as individuals.

In the copulating position, the female is below and the male above, with all legs of the male totally free of the substrate. He clutches the female with the anterior 2 pairs of legs, with the posterior pair either extended freely or also clutching the female. On firm substrates, all locomotory movements are made by the female while the male gets a "free ride". Swimming movements on the water surface are probably also made only by the female.

While we had observed individuals of numerous species of *Nebria* displaying navigatory skills on the surface of streams, it was surprising to see a copulating pair demonstrate these same abilities. The full significance of this behavior pattern in the copulating pair will become evident only after much more study. We are confident that our observations are not of artifacts of our activity in the area. The facts that no uncoupled individuals were seen on the emergent rocks, that few copulating pairs were seen on the bank, and that the pairs in the stream had already reached and settled on the rocks before our arrival, all indicate that the observed behavior is natural.

The ability of individuals of many species of *Nebria*, as well as those of many other carabid species, to navigate on the surface of flowing water is easily observed. For organisms which occupy a riparian habitat, the capacity to return to the bank after a "voyage" (whether intended or accidental) is a valuable if not necessary one. The ability to remain on the water surface is probably essential; but to be able also to navigate on the surface, against or across the current, may prevent an individual from being swept downstream and effectively removed from its population. This is most important for those organisms which live in restricted altitudinal zones along mountain streams. In such instances, to be swept downstream is to be displaced from a habitat suitable for both reproduction and survival. This displacement may be irreversible for wingless forms.

It may be simplest to view the navigatory capacity of these beetles strictly as adaptation to the hazards of the riparian habitat. However, observations of behavior such as that outlined above suggest that much more may be involved. Indeed, the extent to which organisms in this habitat use the adjacent waterway for "intentional" (such as simple locomotion, dispersal, etc.) rather than accidental movements has been virtually unexplored. Perhaps the distinction between the terms "terrestrial" and "aquatic" is far more arbitrary than we now realize.

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BOOK REVIEW

Classification and biology by R. A. Crowson. 1970. Atherton Press Inc., 70 Fifth Ave., N.Y., N.Y. 10011. 350p.; $8.95, cloth.

Most of our readers are familiar with the author's major work on beetles, "The natural classification of the families of Coleoptera" first published in 1955 and reprinted in 1968. This new book on classification was 10 years in preparation and has numerous innovative approaches to the subject. Crowson readily admits that (like Hennig, but independent of his ideas) his is a "... strictly phylogenetic approach to the subject." The book contains 22 chapters, a bibliography of 217 titles, and a thorough index of 30 pages. As would be expected, beetles are often used as examples to clarify general points.

The book contains a great amount of personal opinion and general philosophy—but an honest appraisal of current problems. His chapter on the "working taxonomist" contains so many truths that it emphasises the discouraging aspects of his chapter on "the future of systematics." Very few sciences are burdened with the volume of literature and the inherent difficulties of our nomenclatural system. Crowson states it thusly, "In order to be in a position to make permanently valuable additions to botany and zoology, each generation has need first to assimilate and evaluate all that its predecessors have achieved. Real scientific progress has meant that this task has become more and more onerous for each succeeding generation." How true it is.—R. E. Woodruff.

Book Notices

Animal forms and patterns; A study of the appearance of animals by Adolf Portmann (translated by Hella Czech), illustrated by Sabine Baur. 1971. Schocken Books, 67 Park Ave., N.Y., N.Y. 10016. 254 p.; 121 fig.; $2.75, paperback. (An interesting approach to animal study with some beautiful pen and ink drawings.)

Ecology, pollution, environment by Amos Turk, Jonathan Turk, & Janet T. Wittes. 1972. W. B. Saunders Co., W. Washington Square, Philadelphia, Pa. 19105. 217 p.; 59 fig.; $3.95, paperback.

Population, environment, & people edited by Noel Hinrichs. 1971. (for the Council on Population and Environment) Foreword by Rene Dubos. McGraw-Hill Book Co., 330 W. 42 St., N.Y., N.Y. 10036. 225 p.; no fig.; $2.95, paperback. (24 original essays by different authors).

The natural world: Chaos & conservation edited by Cecil Johnson. 1972. McGraw-Hill Book Co., 330 W. 42 St., N.Y., N.Y. 10036. 266 p.; no fig.; $5.95, cloth. (A selection of 16 extracts from published writings of such famous writers as Rachel Carson, John Muir, Konrad Lorenz, W. O. Douglas, and Paul Ehrlich).

Americans and environment; the controversy over ecology edited by John Opie. 1971. D. C. Heath & Co., 125 Spring St., Lexington, Mass. 02173. 203 p. (Another collection of 18 chapters by early and contemporary authors such as R. W. Emerson, Theodore Roosevelt, John Muir, Rachel Carson, Paul Sears, etc.).

Directory of environmental information sources. (2nd Edition, 1972). Introduction by M. M. Kessler; C. E. Thibeau, editor and P. W. Taliaferro, assoc. editor. Published by the National Foundation for Environmental Control, c/o Cahners Books, 89 Franklin St., Boston, Mass. 02110. 457p. $25.00, cloth (8½x11"). [With the voluminous amount of literature appearing on the environment and the number of environmental agencies proliferating, this directory serves to bring some order out of chaos. It lists government agencies, educational institutions, public and private groups, and professional and trade organizations. It provides a list of published bibliographies, abstracts, directories, and indices, as well as symposia and conferences, documents and reports, serials and periodicals, books, and films and filmstrips.]

Conserving life on earth by David W. Ehrenfeld. 1972. Foreword by Archie Carr. Oxford University Press, 200 Madison Ave., N.Y., N.Y. 10016. xv + 360p. Numerous excellent photos. $10.00, cloth.

Geographical ecology; patterns in the distribution of species by Robert H. MacArthur. 1972. Harper & Row, Publishers, 49 E. 33rd St., N.Y., N.Y. 10016. xviii + 269p. $12.95, cloth. [Highly recommended for taxonomists and ecologists.]

Ecology; the experimental analysis of distribution and abundance by Charles J. Krebs. 1972. Harper & Row, Publishers, 49 E. 33rd St., N.Y., N.Y. 10016. x + 694p.; 39 tables. $14.00, cloth.

A CATALOGUE OF THE GENUS *LIXUS* F. FOR AMERICA NORTH OF MEXICO (COLEOPTERA: CURCULIONIDAE)[1]

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Abstract

A catalog is presented for 28 species of *Lixus* of U. S. and Canada. Synonymy and distribution are given.

Introduction

The genus *Lixus* is represented in America north of Mexico by 28 valid species. Members of this genus are medium sized, elongated, cylindrical weevils of usually reddish brown, gray or black appearance, and are stem-borers in long-stemmed plants. About 560 species are known for the world (Csiki, 1934).

The format used herein is similar to that planned for use in the projected Catalog of North American Coleoptera. Under each name, the following items are given: author, date, page number, type locality, synonymical notes, and with distribution listed state by state after each valid name. The type locality is the first state, province, area or locality given and is set off by a semicolon.

Abbreviations used for states are those of the U. S. Postal System. The following abbreviations have been devised for the Canadian provinces listed: Alberta—AB; British Columbia—BC; Manitoba—MB; Northwest Territory—NT; Ontario—ON; Quebec—QB; Saskatchewan—SK.

LIXUS FABR.

Lixus Fabricius, 1801:498. Type-species: *Curculio paraplecticus* Linnaeus, 1758. (Latreille, 1810:430. Subseq. design.)

amplexus Casey, 1891:199. FL; SC.
  mephitis Chittenden 1930:23. SC, Myrtle Beach. (N. Syn.)
asper LeConte, 1876:156. CA, Owens Valley; AZ.
aspericollis Chittenden, 1930:3. KS, Garden City; IL, KS.
buchanani Chittenden, 1930:16. IA, Lake Okoboji; MO.
caudifer LeConte, 1876:156. IL; BC, IL, MB.
concavus Say, 1831:14. IN; AR, CO, CT, DC, DE, GA, IA, IL, IN, KS, KY, MA, MD, MI, MN, MO, MS, MT, NB, NC, ND, NJ, NY, OH, OK, PA, SC, TX, UT, VA.
  rectus LeConte, 1876:158. NY.
  soror Casey, 1891:204. MT, Helena. (N. Syn.)
  crassulus Notman, 1920:31. NY, Schoharie. (N. Syn.)
  coloradensis Chittenden, 1930:4. CO. (N. Syn.)
fossus LeConte, 1876:416. FL, Enterprise; LA, MS, NJ, NY, SC, TX.
  luculentus Casey, 1891:209. FL, Lake Worth. (N. Syn.)
  pusio Blatchley, 1928:250. FL, Dunedin. (N. Syn.)
  plucheae Chittenden, 1930:17. TX, Brownsville. (N. Syn.)
  fossus ocellatus Chittenden, 1930:18. NY, Coney Is.

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[1] Extracted from a thesis submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at the University of Illinois, 1961.

[2] Mail address: c/o U. S. National Museum, Washington, D. C. 20560.

julichi Casey, 1891:208. NJ; DC, IL, NJ, NY, PA, VA.
laramiensis Casey, 1891:204. WY; AB, CO, IA, MA, NH, NJ, UT, WY.
bischoffi Fall, 1921:40. NJ, Berkeley Hts. (N. Syn.)
macer LeConte, 1876:160. NB; CO, DC, IA, ID, IL, IN, KS, LA, MD, MI, MO, NB, NC, OH, OK, ON, OR, TX, UT, VA, WI. (Resurrected name)
fimbriolatus of authors, not Boheman, 1836.
novellus Blatchley, 1925:101. IN, Steuben Co. (N. Syn.)
capitatus Chittenden, 1930:19. MD, Chevy Chase. (N. Syn.)
blatchleyi Csiki, 1934:120. (new name for *cavicollis* Blatchley) (N. Syn.)
cavicollis Blatchley, 1922:113. MI, St. Joseph. (preocc. Champion, 1902)
maritimus Fall, 1913:39. CA, Sta. Monica.
merula Suffrian, 1871:168. Cuba; FL, MA, TN, TX, VA.
sexualis Casey, 1891:212. TX, Austin. (N. Syn.)
mucidus LeConte, 1876:158. IL; CA, IL, IN, KS, MA, NB, ND, NJ, OH, ON, PA, QB, SD, UT.
morulus Blatchley, 1916:339. IN, Kosciusko Co. (N. Syn.)
nitidulus Casey, 1891:210. IN; AL, AR, DC, IA, IN, KS, LA, MD, MO, MS, NY, OH, PA, VA.
deceptus Blatchley, 1916:341. IN, Starke Co. (N. Syn.)
tricristatus Chittenden, 1930:12. IA, Iowa City. (N. Syn.)
obesulus Casey, 1891:211. FL, Tampa; AL, FL.
loedingi Chittenden, 1930:20. AL, Mobile. (N. Syn.)
oregonus Casey, 1891:200. OR; TX.
eximius Casey, 1891:201. TX, Austin. (N. Syn.)
parcus LeConte, 1876:157. CA; AB, CA, IA, IL, IN, KS, MT, NB, OK, ON, SD, TX. (Resurrected name)
pygmaeus Casey, 1891:203. KS. (N. Syn.)
perforatus LeConte, 1876:159. CA, Ft. Tejon; CA.
perlongus Fall, 1913:39. AZ, Chiricahua Mts.; AZ.
pervestitus Chittenden, 1930:14. AZ, Phoenix; AZ, NM.
placidus LeConte, 1876:159. CO.
punctinasus LeConte, 1876:157. OH; CO, FL, IA, KS, LA, NB, NJ, OH, OK, PA, TN, TX, WI. (Resurrected name)
albisetiger Chittenden, 1930:2. TX, Brownsville. (N. Syn.)
planicollis Chittenden, 1930:13. IA, Iowa City. (N. Syn.)
elephantulus Chittenden, 1930:24. IL, Havana. (N. Syn.)
rubellus Randall, 1838:41. MA, Cambridge; AB, BC, CA, IL, MA, MB, MI, NB, NT, ON, OR, PA, QB, SD, SK, UT, VT, WI, WY.
auctus LeConte, 1860:57. OR. (N. Syn.)
scrobicollis Boheman, 1836:84. America boreal; AL, AR, CO, DC, FL, GA, IN, KS, KY, LA, MD, MI, MO, MS, NC, NJ, OH, OK, PA, SC, SD, TN, TX, VA, WV.
sylvius Boheman, 1843:430. Carolina. (N. Syn.)
laesicollis LeConte, 1876:160. TX.
acirostris Chittenden, 1930:6. NC, Black Mts. (N. Syn.)
ordinatipennis Chittenden, 1930:7. LA, Opelousas. (N. Syn.)
quadratipunctatus Chittenden, 1930:8. CO, Colorado Springs. (N. Syn.)
quadratipunctatus Chittenden, 1930:8. CO, Colorado Springs. (N. Syn.)
sylvius profundus Chittenden, 1930:9. MO, St. Louis, (N. Syn.)
ivae Chittenden, 1930:11. LA, Baton Rouge. (N. Syn.)
dissimilis Chittenden, 1930:11. GA, Barnesville. (N. Syn.)
semivittatus Casey, 1891:207. AZ, Seligman; CO, UT.
perstriatus Chittenden, 1930:5. CO, Cortez. (N. Syn.)
crassipunctatus Chittenden, 1930:9. AZ, Sta. Rita Mts. (N. Syn.)
sobrinus Casey, 1891:205. TX; AL, DC, IL, IN, LA, TX, WI.
regularipennis Chittenden, 1930:21. IN. (N. Syn.)
cleonoides Chittenden, 1930:22. TX, Stamford. (N. Syn.)
tenellus Casey, 1891:201. TX, Ft. Worth; FL, GA, SC, TX.
leptosomus Blatchley, 1914:249. FL, Sanford. (N. Syn.)
terminalis LeConte, 1876:157. Middle States; AB, CA, GA, IA, IL, IN,

KS, MA, MD, MO, MT, NB, NC, NY, OH, ON, PA, SC, SD, TN, TX, VA, WA, WI.
blakeae Chittenden, 1928:90. CA, Stanford. (N. Syn.)

Unrecognized Species

Lixus lateralis Say, 1831:14, from Missouri is a secondary homonym of *L. lateralis* (Panzer), 1789:20 (*Curculio*). Based on Say's description, the name probably applies to *L. scrobicollis* Boh., but Say's type is lost, and positive identification is not possible.

Lixus marginatus Say, 1831:13. US.

Lixus musculus Say, 1831:14. LA.

Both of these species names have been used by authors, but the types are lost, and the descriptions are too ambiguous for positive association.

Additional Notes

Lixus fimbriolatus Boheman, 1836:42, Mexico, has been used by authors for *L. macer* LeConte. Although the 2 species are closely related, they are distinct. The name *L. fimbriolatus* should be removed from the U. S. lists.

Lixus mixtus LeConte, 1876:416, is now *Cleonus mixtus* (LeConte), NEW COMBINATION.

Lixus lupinus Blatchley, 1914:248, is a synonym of *Cleonus subcylindricus* Casey, 1891: 193, NEW COMBINATION, NEW SYNONYMY.

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AN INTERESTING RECORD OF *TEMNOPSOPHUS BIMACULATUS* HORN (COLEOPTERA: MELYRIDAE)

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On a recent trip to Lake Superior to collect in territory from which many of LeConte's types came, I spent the night at Menominee, Michigan. At dusk on 10 July 1970 I was sweeping weeds along the shore of Lake Michigan. The only catch of interest was a series of small anthicid-like beetles about 2.5mm in length, black with humeral spots, with the base of the pronotum orange. After an extensive literature search by me, Ross Arnett took the specimens to the U.S. National Museum and decided that they were *Temnopsophus bimaculatus* Horn of the family Melyridae. It has been recorded previously from Florida and Louisiana.

MATING BEHAVIOR OF A NEW GUINEA *LUCIOLA* FIREFLY: A NEW COMMUNICATIVE PROTOCOL (COLEOPTERA: LAMPYRIDAE)[1]

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ABSTRACT

Luciola obsoleta (Olivier) has the most complex mating behavior reported for Lampyridae. It mates in sedentary groups (aggregations?): the basic stages of its mating protocol seem to be (1) sedentary signalling, (2) chasing, (3) walking-luminescing, (4) mounting, and (5) copulating. This behavior suggests that this *L. obsoleta* may be but one of a complex of cryptic species.

Fireflies of many species use luminescent mating signals. Two basic signal systems or behavioral protocols are used in conjunction with light emission (Lloyd, 1971): in *Lampyris noctiluca* L. stationary females glow continuously and flying males approach the glows (System I); in *Photinus* spp. males flash a brief and characteristic pattern and females respond after a species-typical time interval. The males then fly and walk to the females, and during this approach they maintain a flash dialogue (System II). The protocol of the New Guinea firefly, *Luciola obsoleta* (Olivier), differs from both of these systems and is more complex, since it involves not only coded luminescent emissions, but also spatial movements, and perhaps their interplay.

I observed *L. obsoleta* in a small cocoa grove within a second-growth, sea level rain forest near Alexishafen, New Guinea, in September and October, 1969. The first flashes each evening were emitted 8-21 min. after sunset ($\overline{x}=15$, $n=6$), and flashing activity was intermittent from then until dawn. Males flashing during the first few minutes of activity were commonly (in samples on successive nights, 4 of 6 and 4 of 7) those that were just separating from females with which they had coupled the previous night, such pairs having remained motionless in vegetation throughout the day.

SEDENTARY SIGNALLING

The most conspicuous aspect of the behavior of this firefly was its sedentariness—only occasionally did one or a few fly during light emission. Luminescing individuals were usually perched in weeds and the lower branches of cocoa trees, in one or a few scattered and loose aggregations. One aggregation that I studied extensively was approximately 50 ft. in diameter and numbered 50-100 individuals. Most flashing males were standing near, or walking along, the edges of leaves, and had their heads extended well out from under their pronota and over the leaf edges. In one sample of 20 flashing males, 13 were standing at leaf edges with head extended, 5 were walking along a leaf edge, and 2 were walking, but not at an edge.

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[1] This investigation was conducted during Program C, 1969 Helix Expedition to New Guinea, supported by grant GB8400 for the National Science Foundation to the University of California, Scripps Institution of Oceanography. Vouchered specimens have been deposited in: Florida State Collection of Arthropods; U.S. National Museum, and Cornell University.

The most common luminescent emissions of males were flickers and single flashes, but even to the unaided eye this dichotomy was not distinct. Modulations were often discernible in single flashes, and flickers were often short and erratic (twinkles). Electronic analysis confirmed these visual impressions and revealed other subtleties (Fig. 1-7). Flickers were frequently of short duration (i.e., less than 5 sec) but some lasted 20-30 sec. Frequency of modulations during flickers varied from 3-10 Hz (Hertz)[2] and seldom remained constant for more than 3 sec in a given flicker (Fig. 5). For example, in successive one-sec periods in one recorded flicker, frequencies were 4.1, 4.5, 4.7, 5.3, 6.5, 7.3, 6.3, 6.2, 6.3, 6.0, 6.4, 6.6, 6.1, 5.0, 4.5, 3.2; and in another 7.2, 6.6, 7.5, 7.8, 6.6, 6.2, 5.6, 7.5, 6.5, 7.3, 7.0, 7.3, 7.4, 6.9, 7.0, 5.2, 4.3, 6.8, 7.7, 8.5. Males that were emitting single flashes began flickering when I gently touched the leaf upon which they were standing (Fig. 6); the frequencies of these were 7-9 Hz at first, then dropped to 4-5 in 2 or 3 seconds, and in a few seconds ended with the resumption of single flashes.

Single flashes were frequently bimodal or trimodal. The relative intensity and time separation of the modes varied, and the visual impression of some was that their intensity increased in a stepwise manner (Fig. 4). The duration of single, simple flashes was 0.06-0.13 sec ($\bar{x} = 0.10$, $n = 116$, 17 males) (Fig. 2). The duration of bimodal and trimodal flashes was variable (Fig. 7) (such flashes may represent independent, non-synchronous, single flashes of the 2 segments of the light organ). Flash periods or intervals were also variable. For example, consecutive periods (mixture of simple and compound flashes) of 2 perched males were 0.34, 0.34, 0.34, 0.43, 0.60, 0.64, 0.48, 0.60, 0.60, 0.64, 0.62, 0.56, 0.42, 0.58, 0.42, 0.30, 0.18, 0.19, 0.17, 0.43, 0.48; and 0.43, 0.60, 0.16, 0.32, 0.62, 0.73, 3.34, 0.56, 0.40, 0.52 sec.

The luminescent emissions of females appeared to be modulated and unmodulated glows of various intensities. The conspicuously modulated glows (beady glows) sometimes had minor intensity variations superimposed upon the major modulations (Fig. 8 & 9). Glows, that appeared in the field to be unmodulated, sometimes had flickers up to 8 Hz (Fig. 10), and at other times were without modulations (Fig. 11). One female superimposed bright flashes upon a continuous, steady glow (Fig. 12). Both sexes alternated, with no discernible schedule or routine, their 2 basic emission patterns; infrequently 1 emitted a pattern more typical of the other. Unless otherwise noted or illustrated, the descriptions of luminescent signals below are based upon visual observations and impressions, and not electronic recordings.

There was no discernible interplay of signals between sexes as found in American species using signal system II. Occasionally indiyiduals flew a few feet or yards; flying males emitted flickers with frequencies similar to those of perched males, and flying females emitted modulated or unmodulated glows.

[2] Hertz=cycles per second; all recordings made at 25.5°C. (78°F).

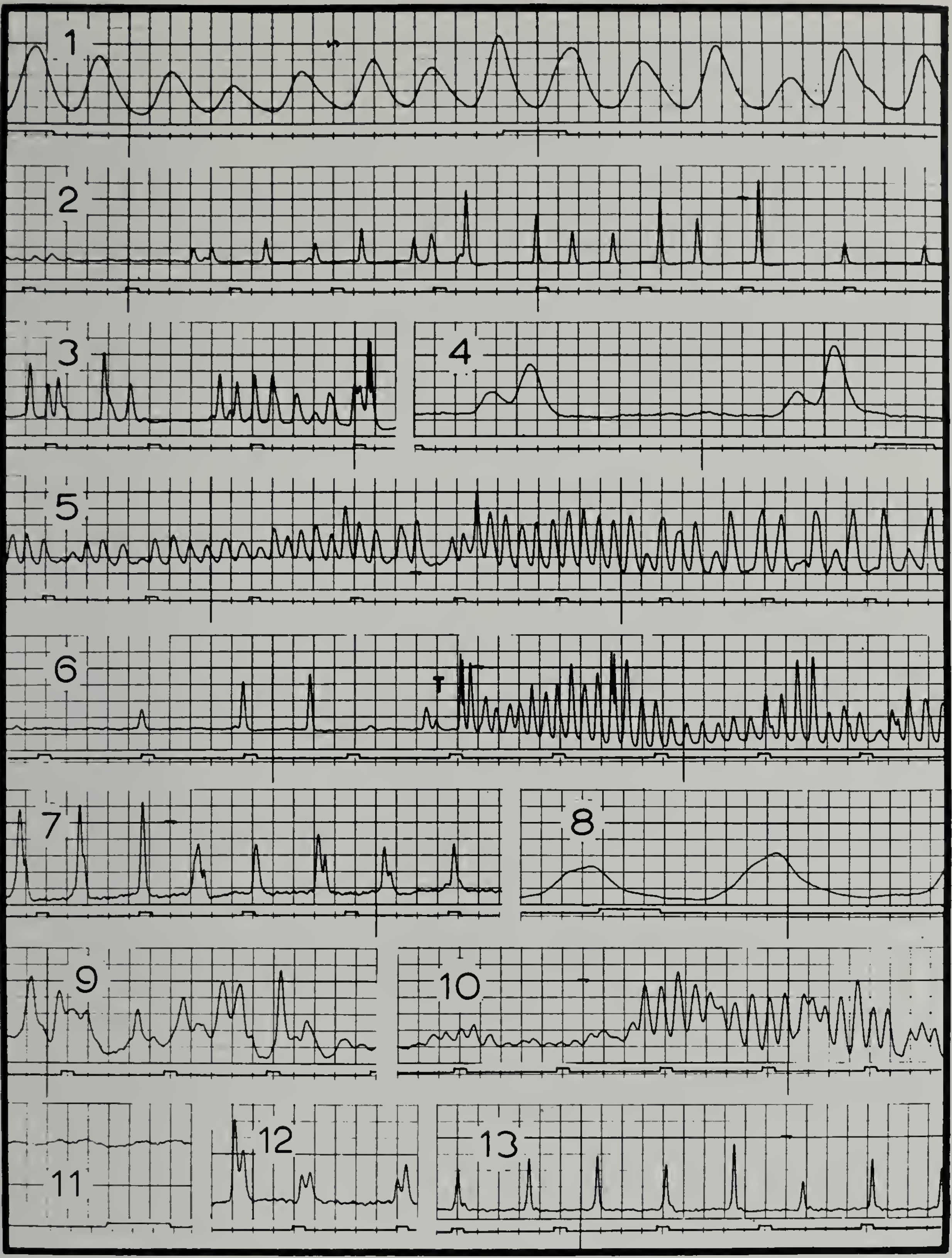

Fig. 1-13: luminescent emissions of *L. obsoleta*. Charts (Brush Mark 220) read left to right. Vertical axis, relative intensity; horizontal axis, time, scale as indicated by 1-sec (period) marker below firefly trace (marker duration 0.12 sec). Recording temperature 25.5°C. 1) Flicker of perched male. 2) Simple and compound single flashes of perched male. 3) Short erratic flickers of perched male (twinkles). 4) Stepped flashes of perched male. 5) Flicker of perched male; note frequency changes and compound modulations. 6) Single flashes, then flicker of perched male; (T) marks moment perch of male was gently touched. Distortions (heavy marks) at peaks of 2 modulations due to very bright modulation overloading recording equipment. 7) Single flashes of perched male; note varying time relationship of flash peaks within compound flashes. 8) Beady glow of perched female. 9) Beady glow with superimposed modulations, of a perched female. 10) Modulated glow of landing female: appeared to be steady glow. 11) Steady glow of perched female. 12) Female flashes superimposed upon glow. 13) CFP (characteristic flash pattern) of male mounted upon female; note period regularity, and changing position of minor peak with respect to major peak.

Many different kinds of interactions occurred between individuals. Both males and females commonly landed a few inches or feet from perched, luminescing ones. Perched males would sometimes begin flashing as a male or female flew over them. Males sometimes hovered and flickered a few inches above perched individuals, darting toward and away from them, and they sometimes landed next to them. Males also flickered and flitted about glowing cigarettes, dim lights on recording equipment, and hand-held vials containing glowing females. They occasionally hovered in front of my unlighted head lamp, perhaps responding to the reflection of their own luminescence.

CHASES

The most conspicuous interactions between individuals were chases of flying, glowing females by flickering males. Usually 1 or 2 males pursued a single female, but chases involving up to 4 males were observed (in 40 naturally occurring chases, 20 involved 1 male, 14 involved 2 males, 4 involved 3 males, 2 involved 4 males). Males joined chases or pursued lone females from as far away as 15 feet and sometimes pursued them 100 ft or more. Glowing females in hand-held vials, and a small penlight, when moved through the air near males, would sometimes elicit pursuit. Chases were observed only after 144-164 min past sunset; before this time, flying females did not elicit male pursuit. This time threshold, first noted through observation of natural chases, was confirmed experimentally by releasing females within a few feet of perched, flashing males.

Chases usually ended within 30 feet of where they started, with the female and 1 male perched within a few inches, usually 4 or less, of each other on a leaf. During a chase males sometimes darted sharply toward and appeared to bump the females, frequently causing the females to drop abruptly and land.

Males were more successful in pursuing and landing with females if no other males participated: in 20 of 27 chases involving 1 male, the male landed with the female; in 3 of 9 two-male chases, 1 landed with the female, in 2 chases both landed with her, and in 4 neither male landed with the female; in 2 of 4 three-male chases 1 male landed with the female, and in 2 such chases none landed with her.[3] In terms of individual pursuit success, percentages are: 74% in one-male chases, 39% in two-male chases, and 17% in three-male chases. Table 1 gives information on some circumstances pertinent to unsuccessful pursuits. The following points seem significant: 8 (of the 28 total) unsuccessful pursuits occurred when the female turned off her light (Ia, IIIa1); and male-male interactions occurred in 12 (Ia1, IIa2, IIb1, IIIb1).

While the glow of a flying female is probably indispensible for eliciting male pursuit (signal function), it also is a beacon for male orientation during the chase. Pursued females eluded males by altering their light emission: 2 females landed and turned off their light; 2 others landed, turned off their light and then flew off without a light; and another began emitting a male-like flash. One series of observations is especially interesting: after copulating for at least 1 hr 35 min, then remaining alone on the perch 5 min, a female flew off in low, hovering flight, glowing. A flashing male flew near, she extinguished her light and dropped to the ground. She then turned on her light and flew upward, the male resumed pursuit, she landed, turned off her light, moved to the other side of the leaf, and flew with her light off and without the male. Other females flew up into the trees or low over the ground and left pursuing males behind.

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[3] These data derived from natural and artificially induced chases.

A number of interactions between males were observed. Many occurred in the presence of females. On 3 occasions males, that had been pursuing females that landed and stopped glowing, hovered over and landed beside flickering males that were perched nearby. They either separated immediately or did not interact further. In 5 two-male chases the males darted and orbited about each other (sparred) at or near the end of the chase.

Table 1: Notes on Unsuccessful Pursuits

I. one-male chases (7 unsuccessful pursuits)
a. female turned off her light ($n=5$)
1. male landed with perched, luminescing male ($n=2$) (no data $n=3$)
b. male "lost" female, dropped out of chase ($n=2$)
II. two-male chases (11 unsuccessful pursuits)
a. other male landed with female ($n=3$)
1. male landed 18" away from female and successful male ($n=1$)
2. male sparred in flight with successful male, then flew off ($n=2$)
b. neither male landed with female ($n=8$)
1. males sparred and flew off together ($n=6$, i.e. 3 prs.) two pairs of males landed together
2. males dropped out of chase separately ($n=2$)
III. three-male chases (10 unsuccessful pursuits)
a. none (of the 3) landed with the female ($n=6$, i.e. 2 trios)
1. female turned off her light ($n=3$)
2. female eluded pursuers ($n=3$)
b. 2 of the 3 did not land with female ($n=4$)
1. males left chase and landed together ($n=2$)
2. males left chase when female and 3rd male landed together ($n=2$) one male flew on, the other returned to his original perch

Table 2: Notes on Successful Pursuits

I. one-male chases (20 successful pursuits)
a. female flew off immediately, left male alone ($n=3$)
b. male mounted female immediately ($n=3$)
c. male and female began walking-luminescing interaction ($n=8$)
II. two-male chases (7 successful pursuits)
a. male landed with female alone ($n=3$)
1. female flew off immediately ($n=1$)
2. male and female began walking-luminescing interaction ($n=2$)
b. male landed with female and other pursuing male ($n=4$, i.e. 2 pairs of males)
1. male remained with female ($n=2$)
A. female flew off immediately ($n=1$)
B. male mounted female immediately ($n=1$)
2. male flew off, left other male with female ($n=2$)
III. three-male chases (two successful pursuits)
a. male landed with female alone ($n=2$)
1. male and female began walking-luminescing interaction ($n=1$)
2. female flew off immediately, male pursued her again, landed with her, male and female began walking-luminescing interaction as in IIIa1 ($n=1$)

In 3 of these the males flew off together, still sparring, and left the female alone. In 2, one of the males landed with the female and the other male flew away.

In other instances of male interactions no females were present: males sometimes pursued flying males for a few feet, hovered near and darted toward perched luminescing males, and others landed beside perched luminescing males. I at first presumed one of the last-mentioned interactions to be a male-female interaction because of the luminescing pattern of the perched male.

Table 2 gives some details of successful pursuits (i.e. when a male pursued a female and landed with her at the end of the chase). In 6 instances the female flew off immediately after landing (Ia, IIa1, IIb1A, IIIa2). In only 1 of these did the male continue pursuit; in 3 the female flew off or dropped from her perch with her light off; and in 2 cases she flew with her light on, but the male did not follow. Figure 14 shows the sequences of continued male-female interactions observed to follow the landing of the 2 on a perch together. In 4 instances males mounted the females immediately (Table 2, Ib, IIb1B; Fig. 14, lower left; n = 4). One of the males was immediately knocked from the female by a raindrop and fell about 2 ft. He then flew back and landed about 1 inch from her. After a brief walking-luminescing interaction (see below) he flew off. In the 3 other cases in which the male immediately mounted the female, the interaction terminated after 1, 1.5 and 4 min. with the female flying away (10 inches, 18 inches, and up into the trees out of sight).

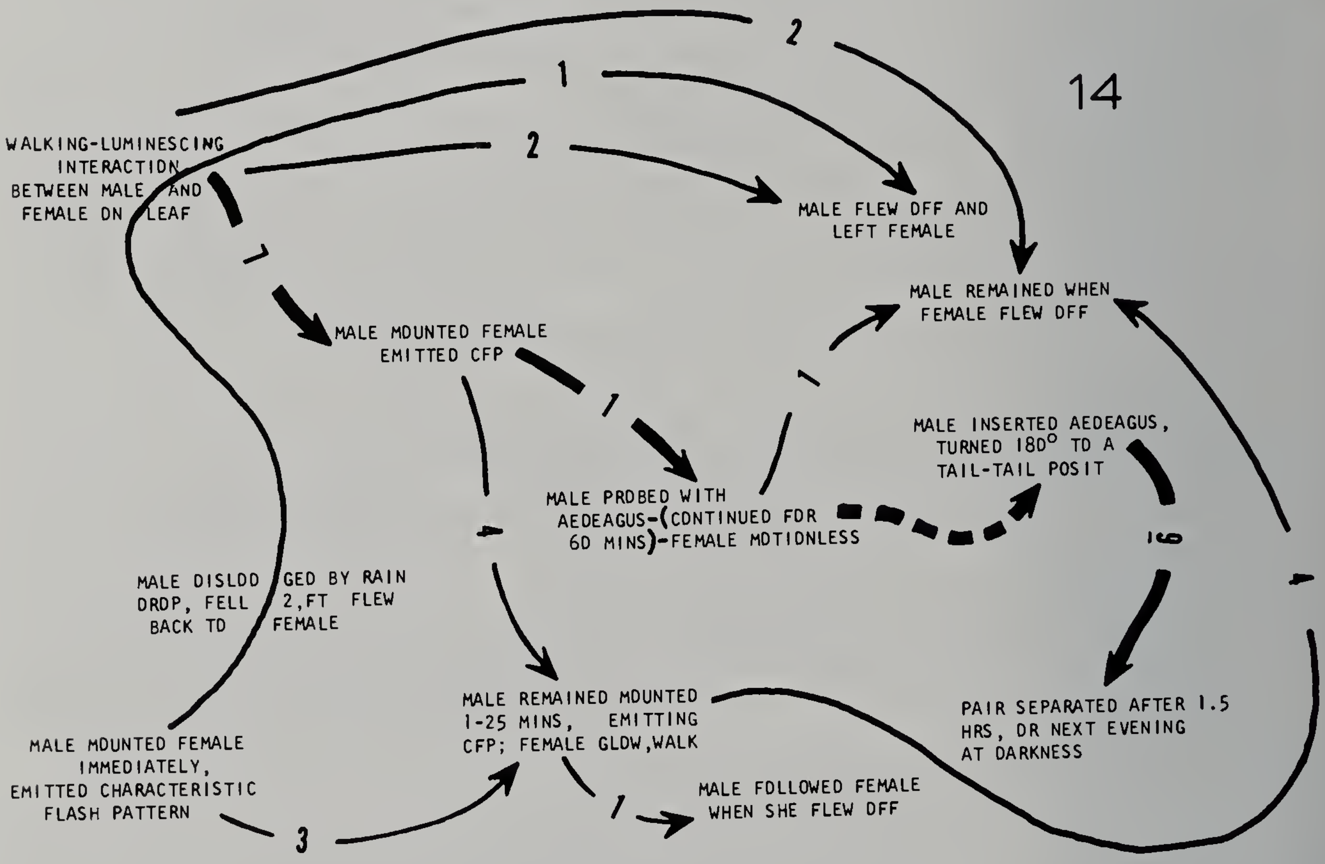
14
WALKING-LUMINESCING INTERACTION BETWEEN MALE AND FEMALE ON LEAF
2
1
2
MALE FLEW OFF AND LEFT FEMALE
MALE REMAINED WHEN FEMALE FLEW OFF
1
MALE MOUNTED FEMALE EMITTED CFP
1
MALE INSERTED AEDEAGUS, TURNED 180° TO A TAIL-TAIL POSIT
MALE PROBED WITH AEDEAGUS-(CONTINUED FOR 60 MINS)-FEMALE MOTIONLESS
1
1
1
1
MALE DISLODGED BY RAIN DROP, FELL 2,FT FLEW BACK TO FEMALE
MALE REMAINED MOUNTED 1-25 MINS, EMITTING CFP; FEMALE GLOW,WALK
PAIR SEPARATED AFTER 1.5 HRS, OR NEXT EVENING AT DARKNESS
MALE MOUNTED FEMALE IMMEDIATELY, EMITTED CHARACTERISTIC FLASH PATTERN
3
1
MALE FOLLOWED FEMALE WHEN SHE FLEW OFF

Fig. 14: Summary of behavior subsequent to chases (natural and artificial), after male and female landed together. Most pairs (n = 11) began walking-luminescing interaction (upper left). In 4 instances male mounted immediately (lower left). Heavy arrows suggest sequence in successful mating. Broken arrow indicates step not actually observed. Numbers indicate observations.

WALKING-LUMINESCING INTERACTION

The next distinctive phase of mating behavior occurred after a male and female landed together at the end of the chase: it involved walking and luminescing (Fig. 14, upper left; n = 11). I observed 7 such interactions from beginning (landing) to end (mounting), and portions of 9 others. I discerned no lengthy stereotyped behavior sequences (reaction chains, Bastock, 1967) but noted a number of single elements common to some or all, and recurring combinations of 2 or 3 elements. In all interactions the predominant luminescent emission patterns of males were the same ones that predominated during the sedentary signalling phase—single flashes and flickers. In verbal notes (n = 52) on tapes made during observations, sequences of single flashes were noted 28 times; flickers, 8; rapid twinkles, 7; stepped flashes, 6; and beady glows, 3. The main emission patterns of females were glows (n = 20) and beady glows (n = 11), the ones that predominate in sedentary signalling. Other patterns were occulted glows (= glows with brief off periods) (n = 3), slow, dim pulses (n = 1), and glows with stepped modulations (n = 1).

Recurring locomotor elements were: male walks to female; female walks to male; male walks away from female; female walks away from male; male runs away from female; both motionless. The combinations of these elements noted were: male walks to female, male runs away quickly; female walks away from male, male walks immediately behind female; female walks to male, male walks to female; and female walks away from male, male walks away from female. Locomotor and luminescent elements were combined: female walks to male, male emits bright flicker; male walks to female, female glow intensity greatly increases; male emits bright pulses, female greatly increases glow intensity, female turns to face male; male and female motionless within 2 inches of each other, emit main luminescent patterns; male emits flicker and walks away from female; and female walks to male, male emits bright single pulses, male mounts female.

The following excerpts from descriptions of walking-luminescing interactions, modified from tape transcripts, better indicate the general nature of these interactions and give additional information about them: (1) pair on leaf 4 inches apart—female glows, male emits combination of bright pulses and flickers—male walks to female, then dashes away very quickly, she walks toward him and he emits a bright flicker—her glow intensity changes from time to time—female walks toward male, he toward her, they stop 0.5-0.75 inches apart—he flies off, she flies to ground; (2) pair on underside of leaf 0.75 inches apart—female glows, male emits rapid twinkles, then dims—male turns and faces female, female turns, walks away to 1.5 inches, stops—her body at right angles to his body axis—female glow occasionally broken with 2-sec dark periods (occulted) —male emits dim flashes, female emits beady glow, male twinkles rapidly, then emits bright crescendos, then rapid twinkles, dim single flashes—both remain motionless, body positions the same—female glow dims, then brightens, male twinkles rapidly then emits dim single flashes—female emits dim single flashes, then a dim glow, he emits bright single flashes, then rapid twinkles—he walks to her (1.5 inches), turns and runs away to 3 inches, then to 5 inches, her glow is occulted then beady . . . she emits dim glow, now beady, he emits stepped-flashes (Fig. 4)—he emits bright single flashes and walks to her, then a bright flicker, she flies away and he emits rapid twinkle, then stops . . .

Walking-luminescing interactions observed in their entirety lasted 1-4 min ($n = 8$), although one interaction, observed only in part, endured 40 min; they terminated with the male emitting a characteristic flash pattern consisting of very bright flashes at intervals of approximately 0.5 sec and mounting the female ($n = 7$), with the male flying away ($n = 3$), or with the female flying away ($n = 2$) (Fig. 13 and 14).

MOUNTING

The next distinctive stage of the male-female interaction was the mounting of the female by the male. In some cases this occurred immediately after the 2 had landed together (Table 2, Ib, IIb1B; Fig. 14), but more often it followed the walking-luminescing interaction described above. In either case it was always ($n = 11$) accompanied by a series of rhythmic, very bright flashes, the major component of each being 0.08-0.11 ($\bar{x} = 0.09$, $n = 43$, 1 male) (Fig. 13) sec in duration and with a period of 0.67-0.72 ($\bar{x} = 0.71$, $n = 46$, 1 male). In some instances males began this flash pattern a few seconds before mounting, but usually they began immediately before or while mounting. While males mounted and flashed, females were usually (9 of 11) motionless and did not luminesce, but since none of the mountings I observed progressed to copulation I do not know the behavior that is characteristic of successful courtship. Occasionally (2 of 11) females glowed and walked about during the entire time the male was mounted. One male remained mounted for 25 min and another for 60 min, although other pairs separated after 1.5-4 min. Some males, while mounted, flexed and extended (made probing motions with) the tips of their abdomens with genitalia extruded. At separation females appeared to take the active role. One male was able to briefly remount, but again the female left him. While mounted, males antennated the pronota of their females and grasped them with all legs: forelegs were positioned just anterior to the mid-elytra and the hind legs at the anterior edge of the elytral apical curves.

COPULATION

Although none of the observed mountings led to copulation, several pairs were found already coupled. One pair was 2 inches above the ground on the undersurface of a blade of grass in a tail-to-tail position about 130 min after the beginning of chasing activity. The female glowed, nearly continuously, and the male emitted flickers and single flashes. They separated 95 min later. Then the male flew away immediately while the female remained on the perch emitting a beady glow for 5 min. When she flew, males perched nearby chased her and she eluded them. Other pairs were found during daylight and at dusk when flashing first began as noted above. One female apparently mated more than once; I marked her with paint at dusk when I found her a few inches from a male moments after he began flashing (see above), and I found her 24 hr later, again a few inches from a male that had just started flashing. One possible explanation for the absence of chases during the first 2 hr after sunset may be that during this time a high proportion of flying females have just completed copulating, and are flying about ovipositing before becoming receptive to males again.

DISCUSSION

Pair formation in *L. obsoleta* is by far the most complex reported for any lampyrid. The fundamental stages seem to be (1) sedentary signalling, (2) chasing, (3) walking-luminescing, (4) mounting, and (5) copulating (Fig. 14, heavy arrows). The chase is perhaps comparable to signal system I found in other fireflies, except that in *L. obsoleta* the female is not a stationary broadcaster; the walking-luminescing interaction, and perhaps sedentary signalling, may involve system II.

The complexity of mating behavior suggests the possibility that *L. obsoleta* is actually a complex of cryptic species, and that the significance of the prolonged mating sequence is that it reduces mating mistakes among very close relatives since it maximizes opportunities (stages 1-4) for identification. It is difficult to understand the evolutionary maintenance of such an intricate and expensive mating system unless each element figures critically in something as indispensable as mating correctness. Ballantyne (1968), in her study of Australian and Indomalayan Luciolini, observed that *L. obsoleta* is morphologically variable in coloration. The 3 series that I collected, at Lae, Goroka, and Alexishafen, differ in coloration but each series is homogeneous. It is even possible, but I believe unlikely, that the study population at Alexishafen was actually composed of 2 (or more) species. Further study will perhaps disclose the presence of several species, and their study would, of course, provide important clues to the approach an experimental analysis of this mating system should take.

ACKNOWLEDGMENTS

I thank J. B. Buck for making this research possible, and his untiring cooperation before, during, and after the Expedition; T. J. Walker and E. G. Farnworth read and made helpful comments on the manuscript; this research was performed during the tenure of N.S.F. Grant GB-7407. Florida Agricultural Experiment Station Journal Series NO. 4331.

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BOOK REVIEW

The insects of Australia; a textbook for students and research workers. Commonwealth Scientific and Industrial Research Organization (CSIRO), Canberra. 1970. Melbourne University Press, Carlton, Victoria, Australia 3053. $19.80 Australian, cloth. (Available in the U.S. from International Scholarly Book Service, Inc., P.O. Box 4347, Portland, OR 97208. $25.70 U.S.). xiii + 1029 p.; 2400 illustrations (8 color plates); 30 authors.

The text for this monumental volume was completed in 1967, the delay in publishing being indicative of the difficulties with such a large volume. The book essentially replaces (not revises) the old standard, Tillyard (1926), which has long been inadequate. The general editor Dr. I. M. Mackerras had the responsibility of seeing the publication through the printers and coordinating the work of the 30 authors. Two of our members authored 2 chapters (H. E. Hinton, Chapt. 4; E. B. Britton, Chapt. 30).

The Australian fauna is relatively depauperate, with 574 families and 54,071 species recorded. These figures will obviously be enlarged when the fauna is better collected and studied.

Dr. E. B. Britton was responsible for the chapter on Coleoptera (p. 495-621). Most of the 238 individual figures in this chapter were executed by F. Nanninga, who also did the 8 beautiful color plates. His meticulous drawings, some of the finest ever done, add immensely to the excellent text. Over 19,000 species of beetles are currently known from Australia. The chapter contains a good general discussion of the Order Coleoptera (p. 495-517) and a systematic account of the Families (p. 517-621).

This volume is, in my opinion, the finest single publication on insects to appear in the past 25 years or more. It is unfortunate that such a tome has not been produced on North American insects. Congratulations to CSIRO and the many authors and artists who produced this fine volume!—R. E. Woodruff.

BOOK REVIEW

The Naturalists Directory (41st ed.) 1972. Published by PCL Publications, Inc., P.O. Box 583, South Orange, N.J. 07079. $5.00, paperback.

This book is primarily a listing of names, addresses, and special interests of over 3000 professional and amateur naturalists throughout the world. Over 500 museums, associations, societies, and periodicals are listed.

The previous edition was in 1968, and numerous (over 500) deletions and changes (over 1,000) are made in this new edition. A great number of entries appear to need updating; a spot check revealed numerous old addresses, deceased individuals, and the Coleopterists Bulletin is still listed as published by Catholic University Press. This updating is one of the most difficult jobs in preparing such a directory. Our members are encouraged to have their addresses and specialties listed free by sending this information to the address above.—R. E. Woodruff.

BOOK REVIEW

Insects by Ross E. Hutchins. 1972. Prentice-Hall, Inc., Englewood Cliffs, N.J. 07632. xii + 324 p.; many photos; $3.50 paperback.

The general approach is through behavior rather than a systematic presentation. Nearly every chapter contains some reference to beetles, and the following chapter headings illustrate the scope: 1) the world of insects; 2) instinct, intelligence, and behavior; 3) the songs they sing; 4) the aerialists; 5) insect migration; 6) the water realm; 7) the hunters; 8) the farmers; 9) the builders; 10) the paper and tent makers; 11) the nectar gatherers; 12) the carpenters, miners, and gall makers; 13) plant curiosities; 14) the pollinators; 15) chemical warfare; 16) of size and strength; 17) of light and color; 18) insects and the future. Hutchins is an excellent photographer, and the many original photos add tremendously to the book. Like most recent general texts, it contains sufficiently unique features to warrant its place on all entomologists' bookshelves.—R. E. Woodruff.

A REVIEW OF THE MEXICAN AND CENTRAL AMERICAN GENUS *TRACHYPHLOEOMIMUS*, WITH NEW SPECIES AND NEW SYNONYMY (COLEOPTERA: CURCULIONIDAE, OTIORHYNCHINAE)

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Abstract

Thamiras Champion (1911) is synonymized under *Trachyphloeomimus* Champion (1911), and 5 new species (*alternatus*, *championi*, *mexicanus*, *sharpi*, and *undulatoides*) of these montane weevils are described from Mexico. A key, photographs of holotypes, descriptions, and illustrations of genitalia are included.

The genus *Trachyphloeomimus* was described by Champion (1911) who included 2 species and 1 variety (the type-species *spurcus* Champion, *solitarius* Sharp, and *solitarius* var. Sharp). In the same publication the genus *Thamiras* was described with a single species *undulatus* Champion. A careful check of these specimens has indicated that *Thamiras* is congeneric with *Trachyphloeomimus* (New Synonymy). Most of the characters used in my key and diagnosis, previously covered by a dirty incrustation, were visible only when specimens were treated in a detergent solution in an ultrasonic cleaner. *T. solitarius* variety is a valid species.

The genitalia were dissected, and they show distinct specific differences. In spite of the greatly diverse genitalia, I believe these species form a natural group and should not be separated at the generic level. Weevils often exhibit great variability in genitalic structures, as can be seen in the genus *Dorytomus* (O'Brien, 1970).

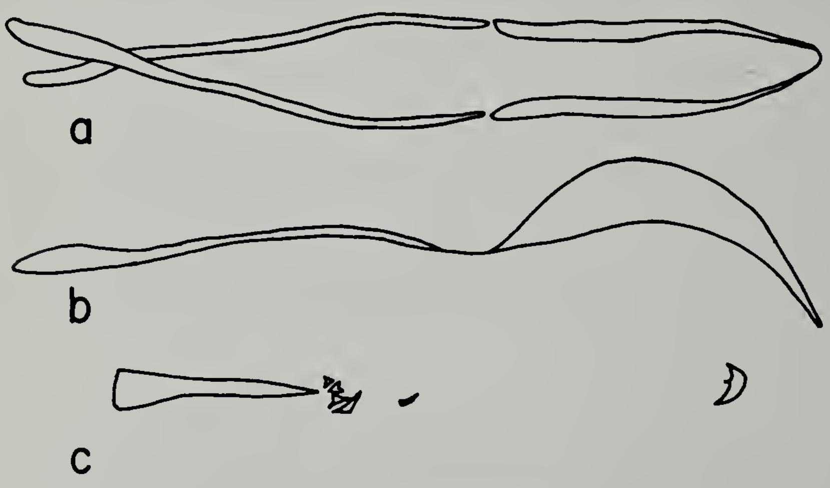
The apparent relictual distribution pattern may be an artifact of collecting. These weevils are relatively rare in collections. Half the species are known from only the type specimen. Recent collecting produced series of 3 species (2 of them new) from under stones in mountain meadows near Mexico City. Perhaps this paper will help to bring more specimens or species of these unusual high altitude weevils to the attention of specialists.

Trachyphloeomimus Champion

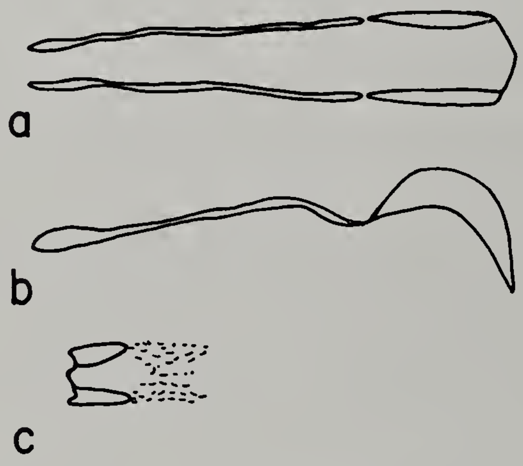
Trachyphloeomimus Champion, 1911:342.

Thamiras Champion, 1911:343, New Synonymy.

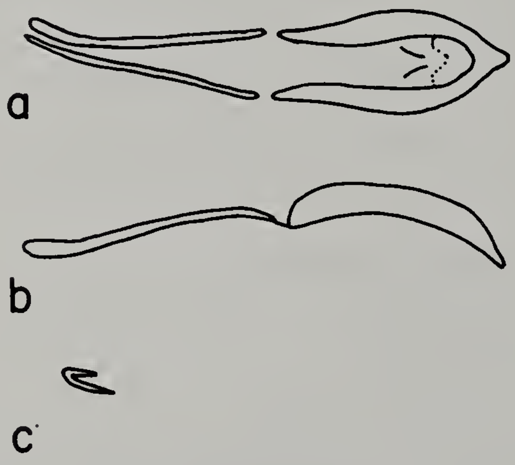
Rostrum at least as long as head, stout, convex in lateral view, widest at apex; nasal plate strongly emarginate, triangular; scrobes visible in dorsal view, descending laterally to lower anterior margin of eyes; eyes coarsely faceted, not prominent, distinctly inset, oval, moderately large; frons foveate or sulcate, with lateral protrusions; antennae with a gradually widened scape reaching the anterior margin of prothorax, clothed densely with scales and erect scalelike setae; funicle 7 segmented, segments 1 and 2 very elongate, 1st at least 1/4 to 1/3 longer than 2nd, 3 and 4 slightly longer than broad, 5 to 7 at least submoniliform, with setae only; club stout, ovate; mentum small; prothorax broader than long, apex strongly constricted, tubulate; scutellum small to minute (may not be visible); elytra much broader than prothorax, oval to elongate oval, humeri distinct, somewhat produced anteriorly; metasternum short, metepisternum very narrowly exposed; ventral abdominal segment 2 as long as



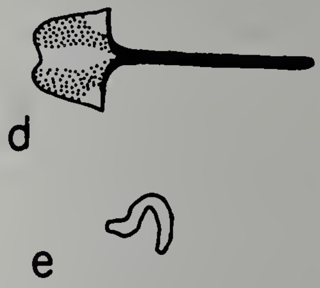
1. championi



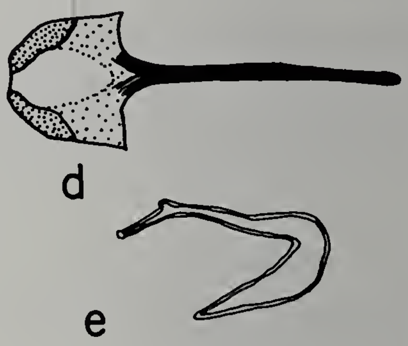
2. sharpi



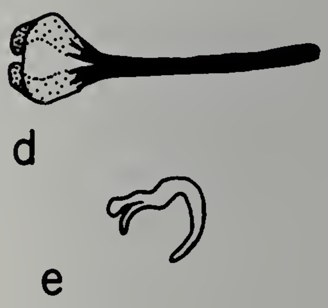
3. mexicanus



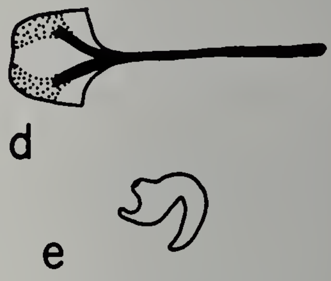
4. solitarius



5. undulatus



6. spurcus



7. mexicanus

Fig. 1-3 male: a) dorsal view of phallus; b) lateral view of phallus; c) sclerotized portions of internal sac.

Fig. 4-7 female: d) dorsal view of eighth sternite; e) lateral view of spermatheca.

3 and 4 united, 1st suture straight to strongly arcuate; femora strongly clavate, unarmed; tibiae uncinate; corbel closed; 3rd tarsal segment broadly bilobed, lobes narrow and widely separated, 4th segment elongate (ca. twice as long as 3rd); claws long, simple, free and widely divergent; body densely squamose, with erect setae; apterous.

Type-species: *T. spurcus* Champion

When Champion (1911) described the genus *Trachyphloeomimus* he included 2 species, *spurcus* Champion and *Trachyphloeus solitarius* Sharp. In the same publication he described the monotypic genus *Thamiras*, type-species *undulatus* Champion. A comparison of Champion's 2 generic descriptions shows 3 significant differences that must be considered since I consider the 2 genera congeneric. Segments 1 and 2 of the funicle are said to be equal in length in *Trachyphloeomimus* and the 2nd longer than the 1st in *Thamiras*. Actually these segments of the type species are identical, the 1st segment nearly 1/3 longer than the 2nd. The subtubulate prothorax is obvious in both species when the incrustation is removed. The feebly arcuate 1st abdominal suture of *Trachyphloeomimus* versus the straight suture of *Thamiras* cannot be used as a diagnostic character either, as among the 8 species now recognized, all degrees of variation are present from straight to strongly sinuate, an extreme of the feebly arcuate form described by Champion.

Key to *Trachyphloeomimus* Species

1. Eighth interval strongly produced behind humeri; declivital tubercles on 5th interval strongly produced; scales on prothorax and elytra recumbent and striate 2

1′. Eighth interval at most weakly produced; if declivital tubercles on 5th interval strongly produced, scales on prothorax and elytra erect, striate, and frayed subpectinate 4

2(1). Setae on inner surface of femora and tibiae very long, longer than width of tibiae; scales on prothorax and elytra sparse, widely separated especially on prothorax; scutellum with fine setae .... *championi* O'Brien, sp. nov.

2′. Setae on inner surface of femora and tibiae ca. ½ width of tibiae; scales on prothorax and elytra dense, touching or imbricate; scutellum glabrous or with clavate scalelike setae 3

3(2′). Rostrum strongly widened at apex, frons narrower, ca. ½ width of apex of rostrum; antennal scape slender, nearly straight; 6th interval tuberculate near declivity .... *undulatus* Champion

3′. Rostrum scarcely widened at apex, frons less narrow, ca. 2/3 width of apex of rostrum; antennal scape clavate, moderately curved; 6th interval not tuberculate near declivity .... *undulatoides* O'Brien, sp. nov.

4(1′). Scales on rostrum, head, and prothorax erect 5

4′. Scales on rostrum recumbent or at most suberect, on head recumbent or at most subrecumbent, and on prothorax recumbent 6

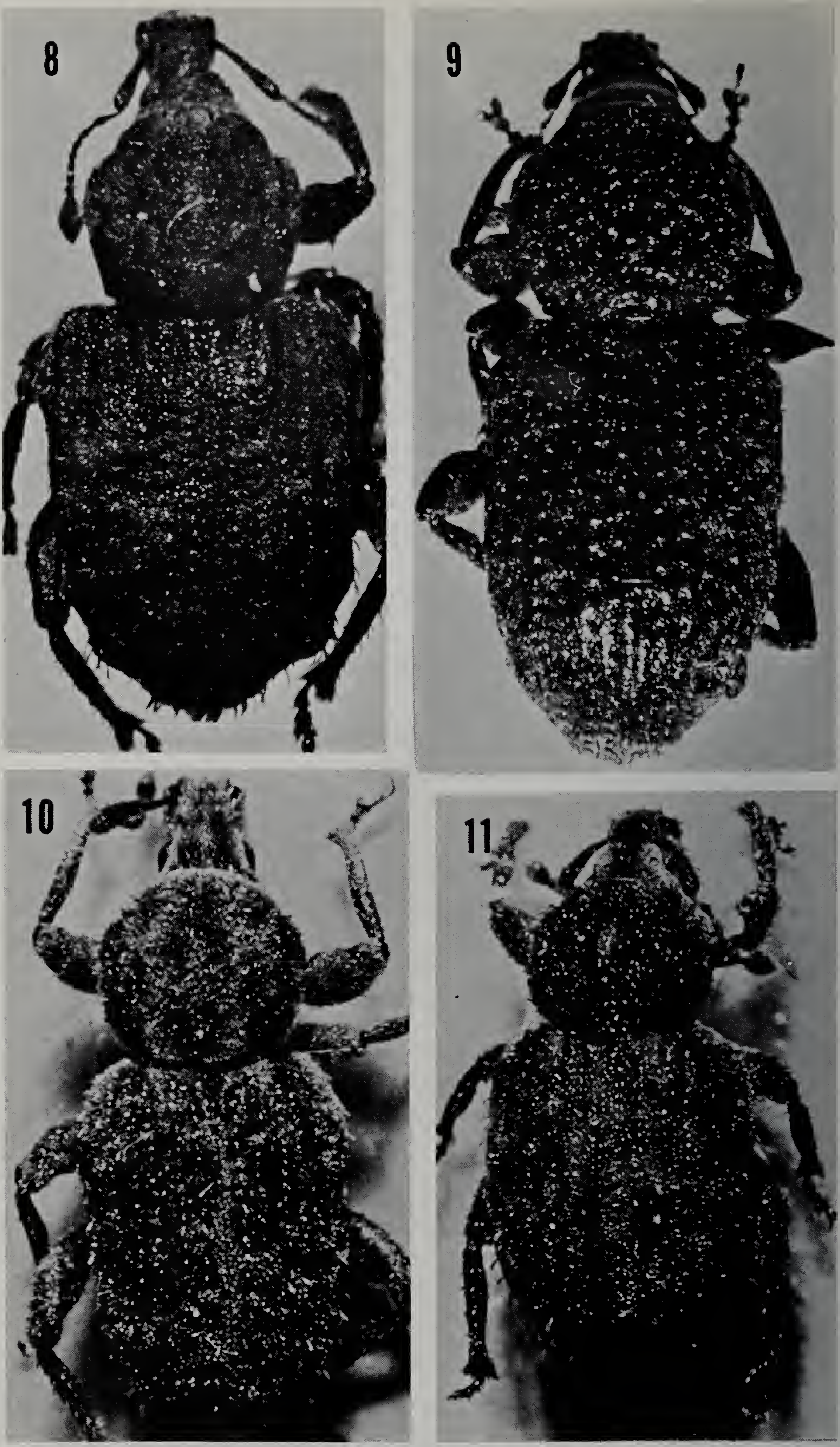


Fig. 8-11 *Trachyphloeomimus* spp.: 8) *undulatus*; 9) *championi*; 10) *sharpi*; 11) *solitarius*.

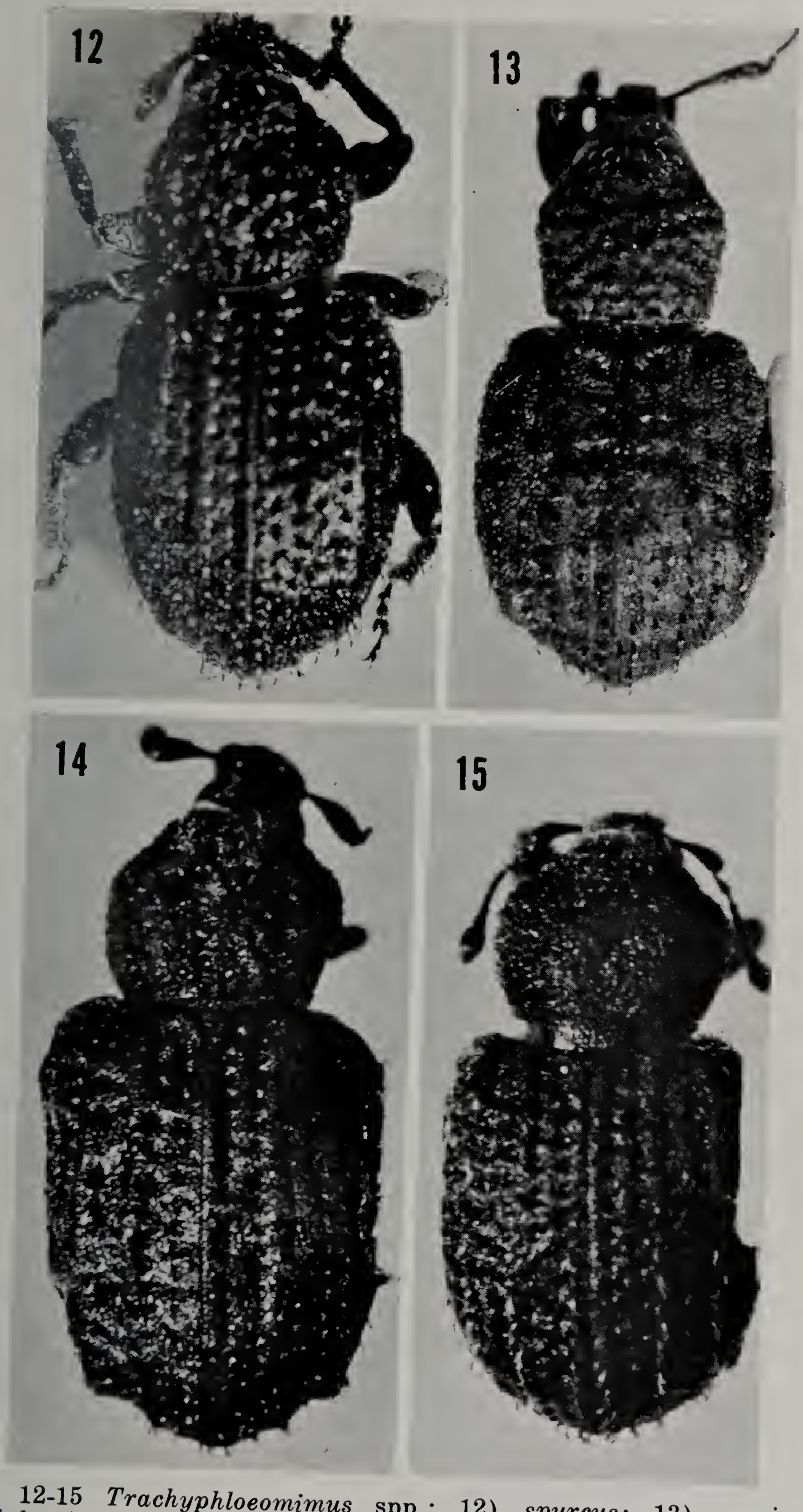


Fig. 12-15 *Trachyphloeomimus* spp.: 12) *spurcus*; 13) *mexicanus*; 14) *undulatoides*; 15) *alternatus*.

5(4). Head and prothorax with small papillae-like tubercles, clothed with erect stellate scales .... *solitarius* Sharp

5′. Head and prothorax with punctures and erect, striate, and frayed subpectinate scales .... *sharpi* O'Brien, sp. nov.

6(4′). Humeri formed from base of 7th interval, 7th interval weakly convex, 8th interval slightly expanded behind humerus 7

6′. Humeri formed from base of 6th interval, 7th interval strongly convex, 8th interval not expanded .... *mexicanus* O'Brien, sp. nov.

7(6). Prothoracic punctures covered with scales; basal 1/3 to ½ of even intervals lacking setae; apical area of rostrum with median narrow sulcus, remainder at most finely punctate .... *spurcus* Champion

7′. Prothoracic punctures not covered with scales; all intervals with complete row of setae; apical area of rostrum lacking sulcus, with coarse dense punctures .... *alternatus* O'Brien, sp. nov.

Trachyphloeomimus championi O'Brien, NEW SPECIES

(Fig. 1,9)

Black; clothed moderately sparsely with recumbent striate black and brown and a few white scales; strongly punctured; with sparse erect coarse setae.

Rostrum scarcely wider at apex than base; base to antennal insertion densely clothed with recumbent striate blackish brown scales; with 4 rows of erect coarse black setae; with 3 weak sulci, median ending in apical fovea, lateral sulci beginning in lateral fovea next to eye. Apex with small sparse recumbent golden scales, and very sparse erect fine golden setae. *Head* shallowly densely punctate, clothed with dense recumbent striate scales; frons distinctly though moderately shallowly foveate; lateral protrusions not extending over eyes, clothed with black subrecumbent scales and 3 erect black scalelike setae. *Antennae* with stout, nearly straight scape clothed with moderately dense recumbent striate black scales and sparse erect coarse setae, funicle with sparse fine golden setae. *Prothorax* with sides broadly rounded from base to suddenly constricted weakly tubulate apex; unevenly very coarsely deeply rugosely punctate; areas between punctures shining and sparsely clothed with recumbent striate black scales, marginal scales not noticeably paler in color, with sparse erect fine to moderately coarse brown to black setae. *Scutellum* small, round, subglabrous, with small fine setae. *Elytra* with subrectangular humeri at approximately a 60° angle with base; interval 8 expanded behind the humeri; strial punctures large, round, moderately shallow, separated by twice their own diameter, each with a small seta, intervals 3, 5, and 7 convex, remainder flattened; 5th interval strongly broadly tuberculate on declivity; moderately clothed with recumbent striate black and brown scales; odd intervals with even rows of erect, narrowly clavate, black scalelike setae, 3 to 4 rows on declivital tubercle, even intervals with few such setae before declivity, then evenly distributed. *Venter* evenly clothed with moderately sparse recumbent striate whitish brown scales, with sparse fine golden brown setae; 1st suture strongly sinuate; 5th segment with a deep broad median depression. *Legs* clothed with moderately dense recumbent striate black scales and sparse very elongate fine golden setae; setae longer than width of tibiae; corbel plate with coarse erect setae. Tarsi densely pubescent ventrally. Length: 5.5 mm.

Holotype: male. Mexico: State of Veracruz, Cofre de Perote, n. slope, 10.0 miles south Las Vigas, 9600 ft., 24-VIII-1967, Ball, T. L. Erwin, R. E. Leech. [C. W. O'B.] (1).

This species appears to be most closely related to *undulatus*, but its very broad frons and much larger size will readily separate them. The very sparse scales, shiny surface, and larger size will readily separate it from all species.

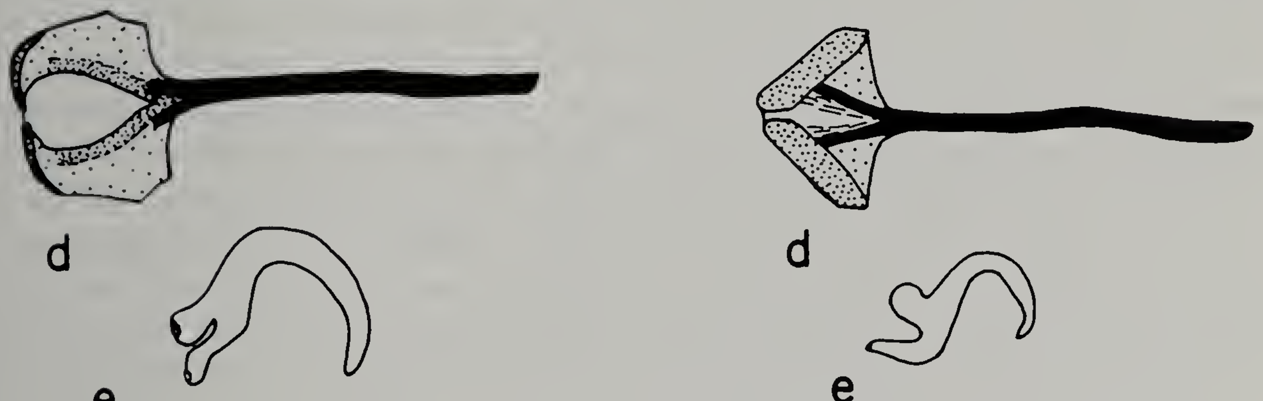
Trachyphloeomimus undulatus (Champion)

(Fig. 5, 8)

Thamiras undulatus Champion, 1911:343, New Synonymy

Black; clothed densely with recumbent striate imbricate black, brown, and a few white scales; with sparse elongate narrow to clavate scalelike setae.

Rostrum strongly widened at apex; base to antennal insertion clothed densely with recumbent imbricate striate scales, strongly convex with a narrow median sulcus, and 4 rows of long erect brownish black scalelike seta; apex shining, subglabrous, with sparse long fine whitish brown setae. *Head* densely clothed with recumbent imbricate striate scales, punctures not visible; frons densely clothed with scales, much narrower (ca. ½) than apex of rostrum, broadly depressed, distinctly separate from rostrum, lateral protrusions weak, not expanded over eyes, with 3 very long erect black scalelike setae. *Antennae* with moderately slender, nearly straight scape clothed with moderately dense recumbent striate black scales and sparse erect coarse setae; funicle with sparse fine golden setae. *Prothorax* evenly expanding from base to suddenly constricted, strongly tubulate apex; densely clothed with recumbent striate black, brown and



16. undulatoides

17. alternatus

Fig. 16-17 female: d) dorsal view of eighth sternite; e) lateral view of spermatheca.

white scales; punctures not visible; surface unevenly undulate with uneven rows of erect coarse scalelike black setae; lateral margin clothed with white scales. *Scutellum* small, triangular, glabrous. *Elytra* with anteriorly projecting humeri, subrectangular, with interval 8 strongly expanded behind humeri; strial punctures unevenly separated, distinct, round, moderately deep, separated by 1 to 1½times their own diameter, each with small fine barely visible seta; intervals 3, 5, and 7 unevenly convex, remainder slightly convex, surface in general unevenly undulating; intervals 5 and 6 tuberculate at declivity; odd intervals with an even row of narrowly clavate black scalelike setae, even intervals with an uneven row of sparse similar setae, becoming denser from base to apex. *Venter* evenly clothed with dense recumbent striate blackish brown scales and sparse suberect fine golden setae; 1st suture straight; 5th segment shallowly indistinctly depressed medially with glabrous finely punctate apex. *Legs* clothed densely with recumbent striate black scales, femora annulate with white scales; with suberect moderately long (less than ½ width of tibiae), coarse brown and white scalelike setae; corbel plate with coarse erect setae. Tarsi densely pubescent ventrally. Length: 4.3 mm.

Holotype: female. GUATEMALA: Totonicapam, 8,500-10,500 ft., VIII-1880, Champion [B.M.N.H.] (1).

This species can be separated readily from all others by the very narrow frons, distinctly rectangular humeri, and tuberculate 6th interval at the declivity. The distinctive undulate surface is found in only 1 other species, *undulatoides*, a somewhat smaller Mexican species.

Trachyphloeomimus spurcus Champion
(Fig. 6, 12)

Trachyphloeomimus spurcus Champion, 1911:342.

Black; clothed densely with recumbent striate black and brown scales; with sparse erect clavate striate black scalelike setae.

Rostrum scarcely wider at apex; base to antennal insertion densely clothed with subrecumbent imbricate striate dark brown scales, with 4 rows of erect, narrowly clavate, striate scalelike blackish-brown setae; with distinct median sulcus and lateral very indistinct sulci, with a pair of deep lateral foveae at base of eyes; apex with moderately sparse recumbent small round golden brown scales and sparse erect brown and golden coarse setae. *Head* shallowly densely punctured, clothed with dense recumbent striate dark brown scales; frons with distinct depression and small round deep median fovea; lateral protrusions distinct, expanding slightly over eyes, clothed with brown and black recumbent scales and 3 long erect brown and white scalelike setae. *Antennae* with stout, slightly curved scape clothed with dense recumbent striate black scales and sparse erect narrowly clavate black scalelike setae; funicle with moderately fine brown and golden setae. *Prothorax* gradually rounded to suddenly constricted, distinctly tubulate apex; unevenly coarsely deeply punctured, punctures hidden beneath scales; with dense recumbent striate black and brown scales; with uneven rows of sparse erect, narrowly clavate, striate black setae; with a pale brown narrow marginal line of scales. *Scutellum* small, triangular, glabrous. *Elytra* with humeri weakly rounded, with 8th interval very weakly expanded behind the humeri; strial punctures small, round, shallow, separated by at least 3 times their own diameter; each with a minute fine seta; all intervals weakly convex, odd intervals somewhat more strongly so, 5th interval with a weak tubercle on declivity; densely clothed with nonimbricate recumbent striate black and brown scales; odd intervals with single even row of erect clavate striate scalelike setae, even intervals nearly lacking such setae before declivity, there becoming denser. *Venter* evenly densely clothed with recumbent striate pale brown, golden, and dark brown scales; with sparse, fine to moderately coarse, suberect setae; first suture evenly distinctly sinuate; 5th segment with broad deep apical median depression and two small lateral depressions. *Legs* densely clothed with recumbent striate black scales, and sparse suberect clavate white, brown and black setae; femora subannulate with brown scales; corbel plate of third tibia sparsely clothed with coarse setae. Tarsi moderately densely pubescent ventrally. Length: 3.8 mm.

Holotype: female. MEXICO: Truqui. Holotype [B.M.N.H.]. State of Mexico, Parque Nacional Miguel Hidalgo, 17-II-1972, 2900 meters, under stones, C. W. O'Brien [C.W.O'B.] (1); same data, except collector S. Rosenthal [C.W.O'B.] (4); Pradera de Salazar, 17-II-1972 [ca. 2900 meters], under stones, C. W. O'Brien [C.W.O'B.] (4); same data, except collector P. Reyes C. [C.W.O'B.] (1); [Pradera de] Salazar, 10-III-1968, A. Barrera [M.H.N.M.] (2); 4-II-1962, M. Olguin [R.M.V.C.] (2); 13-V-1962, M. Olguin [R.M.V.C.] (6); State unknown, Popo Park, 18-VIII-1968, R. Muniz V. [R.M.V.C.] (1).

This species is closely related to *championi* but can be separated readily from it by its smaller size, and denser scale cover. The very small strial punctures will separate it from all other species.

Trachyphloeomimus solitarius (Sharp)
(Fig. 4, 11)

Trachyphloeus solitarius Sharp 1911:177.

Trachyphloeomimus solitarius (Sharp), Champion 1911:343.

Black; clothed with recumbent striate scales and erect radiate-stellate scales, with sparse, unevenly distributed, erect striate clavate scalelike setae.

Rostrum weakly widened to apex; base densely papillate, with erect radiate-stellate black and brown scales on papillae; with 4 rows of erect clavate striate black, brown, and white scalelike setae; with a narrow distinct median sulcus extending onto frons; apex subglabrous with sparse coarse suberect setae. *Head* and frons strongly papillate, with erect radiate-stellate black, brown, and white scales on each papilla; frons depressed with distinct narrow median sulcus, lateral protrusions strongly expanded over eyes, clothed with white radiate-stellate scales and 1 to 3 (partially ribbed) erect, narrowly clavate white setae. *Antennae* with stout strongly sinuate scape, with moderately dense recumbent striate black scales on roughened subpapillate surface, with sparse suberect clavate setae. *Prothorax* with sides rounded at base, median area of sides subparallel, very slightly expanded towards apex, rounded and then constricted and subtubulate; densely coarsely papillate, clothed with erect radiate-stellate black, brown, and white scales; with a median and 2 anterolateral white spots and a narrow marginal white line of scales; with uneven rows of erect striate narrowly clavate black setae; surface only slightly uneven except for papillae. *Scutellum* small, scarcely visible. *Elytra* with humeri slightly projecting anteriorly, then evenly rounded; 8th interval scarcely projecting behind humeri; strial punctures small, round, moderately shallow, unevenly separated, some not visible due to dense scales; each with a minute fine seta; all intervals moderately strongly convex; densely clothed with suberect imbricate striate brown, black, and white scales, maculate; humeral scales white; all intervals with even rows of short erect clavate striate brown and white setae. *Venter* weakly papillate, laterally densely clothed with radiate-stellate white scales, median area with sparse recumbent striate brown scales; with sparse suberect white scalelike setae; first suture weakly sinuate; 5th segment strongly convex, rugosely papillate, with an elongate median apical deep depression. *Legs* subpapillate with recumbent striate black scales; femora subannulate with white scales; with short suberect clavate white and brown setae; corbel plate of third tibia glabrous. Tarsi sparsely pubescent ventrally. Length 3.3 mm.

Holotype: female. MEXICO: State of Durango, Ventanas, Höge. [B.M.N.H.] (1).

This small species appears to be quite distinct from all other species. The papillate surface of the head and thorax and the radiate-stellate scales are very distinctive. Its short oval form is quite distinctive and it lacks any declivital tubercles.

Trachyphloeomimus sharpi O'Brien, NEW SPECIES

(Fig. 2, 10)

Trachyphloeus solitarius variety Sharp, 1911:178.

Black to reddish black; clothed densely with erect striate frayed subpectinate white, black, and brown scales; coarsely punctate and rugosely tuberculate; with uneven rows of erect, narrowly clavate, striate white setae.

Rostrum gradually widened to apex; base to antennal insertion coarsely tuberculate and punctate, with erect striate, unevenly frayed, subpectinate scales and 4 rows of erect striate clavate white setae, with distinct shallow sulcus extending onto the frons; apex with moderately dense recumbent striate white scales and sparse suberect clavate white setae. *Head* rugosely tuberculate, with erect to suberect striate frayed, subpectinate black and white scales; frons clothed with longer erect scales, appearing more convex and separate from head; medially sulcate, with weak lateral protrusions, weakly expanded over eyes, clothed with white scales and 3 long white striate clavate setae. *Antennae* with stout subtuberculate slightly curved scape, with dense erect striate black scales; with sparse erect black and white scales; funicle with coarse to fine brown and black setae. *Prothorax* with base strongly rounded with sides subparallel, very slightly expanded anteriorly, rounded to subtubulate apex; densely coarsely punctured, with sparse tubercles; densely clothed with erect striate frayed subpectinate white, black and brown scales; with a basal median black spot and 2 lateral anteriorly forked black lines; with a narrow marginal white line; with uneven rows of sparse, narrow to clavate, erect, white setae. *Scutellum* small, round, clothed with scales. *Elytra* with humeri slightly produced anteriorly, evenly rounded behind; 8th interval very weakly expanded behind humeri; strial punctures moderately small, round, deep, separated by 1 to 1½ times their own diameter; no setae visible within punctures; intervals 3, 5, and 7 strongly convex, remainder slightly convex; densely clothed with recumbent to suberect striate frayed, frequently subpectinate, white, black and brown scales; with an uneven row of short striate clavate suberect scalelike white and brown setae; 5th interval weakly tuberculate at declivity. *Venter* finely subpapillate and coarsely rugosely punctate; clothed laterally with dense coarse frayed suberect white scales; with suberect clavate white scalelike setae; first suture moderately sinuate, subacutely arcuate at the middle; 5th segment basally convex, rugosely punctate, with broad apical median depression; with sparse suberect fine setae; apical margin smoothly convex, clothed with sparse recumbent pearlescent scales. *Legs* densely clothed with recumbent pearlescent-white striate scales and some white suberect frayed scales; with sparse suberect white clavate striate setae; corbel plate of third tibia clothed with dense recumbent imbricate scales. Tarsi sparsely pubescent ventrally. Length: 3.8 mm.

Holotype: male. MEXICO: State of Puebla, Tehuacan, Höge. [B.M.N.H.] (1).

This species is related to *undulatus* and *championi* but is separated readily from them and all others by the very unusual scale covering. The very pale, apparently grey, color is quite distinct as well.

Trachyphloeomimus mexicanus O'Brien, NEW SPECIES

(Fig. 3, 7, 13)

Black; clothed densely with contiguous recumbent striate black and brown scales; with suberect clavate scales.

Rostrum ca. ¼ wider at apex than base, clothed densely with subrecumbent striate brown scales; with 4 rows of suberect coarse brown setae; with median sulcus; apex subglabrous with a few elongate erect fine setae. *Head* shallowly densely punctate, clothed with dense recumbent striate scales; frons with elongate sulcus; lateral protrusions weak, not expanded over eyes; clothed with dense recumbent striate brown and a few white scales; and with 4 or 5 erect to suberect clavate scalelike setae. *Antennae* with stout, slightly curved scape, clothed densely with recumbent striate brown scales and sparse erect coarse setae, funicle with sparse fine golden setae. *Prothorax* evenly expanding to suddenly constricted apical ¼, apex tubulate, unevenly deeply coarsely punctate with areas between punctures distinctly elevated, with sparse subrecumbent clavate black to brown setae; and with dense recumbent striate black, brown, and white scales. *Scutellum* small, triangular, and glabrous. *Elytra* with humeri slightly projecting anteriorly, subquadrangular, 7th interval expanded behind humeri, 8th interval not projecting; strial punctures scarcely visible due to dense scale cover, anterior punctures round and deep, posterior punctures elongate and shallow, lacking setae; intervals 3, 5, and 7 distinctly convex, sutural interval convex behind declivity, other intervals flat; 5th interval strongly broadly tuberculate on declivity; all intervals with a row of suberect clavate curved striate setae and densely clothed with contiguous recumbent striate brown, black, and brownish white scales. *Venter* evenly clothed with moderately dense recumbent striate whitish brown scales, with sparse fine to coarse golden brown setae; 1st suture weakly sinuate; 1st segment convex; 5th segment with base weakly evenly convex, apex very weakly evenly broadly depressed. *Legs* clothed with dense recumbent striate brown and brownish white scales; with moderately dense, coarse to clavate, erect, short to moderately long (less than ½ width of tibia), brown to white setae; corbel plate with coarse erect setae. Tarsi moderately densely pubescent ventrally. Length: 3.4 mm. (female holotype). *Male*: 1st ventral segment broadly concave; 5th segment with distinct moderately narrow median depression. Length: 2.7 mm. (allotype).

Holotype: female. MEXICO: Tamaulipas, Gomez Farias, Rancho del Cielo, 3700', 4-VII-1969, S. and J. Peck, cloud forest litter, Ber. 165. Holotype, allotype [C. W. O'B.] and 4 paratypes. [C. W. O'B.] (2), [B. M. N. H.] (1), [M. C. Z.] (1).

This species appears to be most closely related to *solitarius,* but its lack of papillae and dense recumbent scale covering are quite distinct. It resembles most closely *spurcus,* but is more brown in color, is smaller, and possesses much shorter setae, especially on the rostrum and prothorax. It also resembles *alternatus* but its punctures are not visible due to its even scale covering, and it has relatively fine punctures on the apex of the rostrum.

Although the elevation of the type locality is much lower than that for the other species, they were collected in a cloud forest.

Trachyphloeomimus undulatoides O'Brien, NEW SPECIES

(Fig. 14, 16)

Black; clothed densely with recumbent, striate, brown, blackish brown, and a few white scales, maculate; with moderately sparse suberect clavate scales.

Rostrum scarcely wider at apex than base; base to antennal insertion densely clothed with recumbent imbricate striate dark brown scales, strongly convex with a deep moderately narrow median sulcus, with 4 rows of erect coarse brown to brownish white setae; apex shining, subglabrous with sparse recumbent golden scales and very sparse long fine golden setae. *Head* densely clothed with recumbent imbricate striate scales, with dense shallow visible punctures; frons densely clothed with recumbent imbricate striate scales, narrower (ca. ⅓) than apex of rostrum, laterally convex, with median sulcus continuous with rostral sulcus, not separate from rostrum, lateral protrusions weak, not expanded over eyes, with 2 long erect coarse white setae and a somewhat more median subclavate brown seta. *Antennae* with strongly clavate, moderately curved scape with dense recumbent imbricate striate brown scales and moderately sparse erect coarse brown to brownish white coarse setae; funicle with sparse fine golden setae. *Prothorax* evenly expanding from base to suddenly constricted strongly tubulate apex; densely clothed with recumbent striate black, brown, and white scales; with deep coarse punctures; surface very uneven, with uneven rows of erect coarse scalelike black, brown, and white setae; lateral margin and median depression clothed with white scales. *Scutellum* small, triangular, densely clothed with subrecumbent clavate scalelike white setae. *Elytra* with anteriorly projecting humeri, subrectangular at approximately a 30° angle with base, with interval 8 strongly expanded behind humeri; strial punctures unevenly separated, distinct, round, moderately deep, separated by 1½ to 3½ times their own diameter, each with a minute barely visible seta; intervals 1, 3, 5, and 7 unevenly convex, surface in general unevenly undulating; interval 5 strongly rectangularly tuberculate at declivity, all intervals with an uneven row of clavate brown to white scalelike subrecumbent to suberect setae, denser on odd intervals. *Venter* evenly clothed with dense recumbent striate brown scales and sparse suberect moderately coarse white to golden setae; 1st suture weakly bisinuate; 5th segment with 3 deep evenly spaced small apical depressions; margin raised, shining, with moderately dense fine whitish setae. *Legs* clothed densely with recumbent striate black scales, femora annulate with white scales; with suberect moderately long (ca. ½ width of tibiae) coarse brown and white scalelike setae; corbel plate narrow, glabrous. Tarsi densely pubescent ventrally. Length: 3.8 mm.

Holotype: female. MEXICO: State of Mexico, Parque Nacional Miguel Hidalgo, ca. 2900 meters, under stones, C. W. O'Brien, Holotype [C.W.O'B.]. Three paratypes, same data, except collector S. Rosenthal [B.M.N.H.] (1), [C.W.O'B.] (2); One paratype, Pradera de [meadow of] Salazar, [ca. 2900 meters], 17-II-1972, under stones, C. W. O'Brien [C.W.O'B] (1). One paratype, state unknown, Llano Grande, 6-V-1962, M. Olguin [R.M.V.C.] (1).

This species closely resembles the Guatemalan *undulatus*. It can be easily distinguished by its lack of a tubercle at the declivity of the 6th interval and its very distinctly scale-covered scutellum. The scales may be rubbed in older specimens. It is smaller, but longer series may indicate an overlap in size. The very strongly undulate surface will separate it from other species.

Trachyphloeomimus alternatus O'Brien, NEW SPECIES

(Fig. 15, 17)

Black; clothed with recumbent imbricate striate scales, with moderately dense suberect striate clavate scalelike setae.

Rostrum weakly widened to apex; base moderately convex laterally, with a narrow median sulcus, clothed densely with suberect striate scales with 4 rows of erect clavate scalelike setae; apex coarsely punctured with sparse golden and greenish white recumbent scales, and coarse erect brown and white setae. *Head* with dense subrecumbent striate scales, punctures scarcely visible; frons with narrow median sulcus, clothed with dense suberect striate scales and several erect clavate scalelike setae, with 3 lateral long white and brown scalelike setae, lateral protrusions weakly expanded over eyes. *Antennae* with stout moderately curved scape, with moderately dense recumbent striate brown scales; funicle with moderately dense coarse golden brown setae. *Prothorax* with sides rounded to a broadly expanded rounded subapex, then suddenly constricted to a tubulate apex; with dense coarse deep visible punctures, with dense imbricate recumbent striate brown, black, and white scales, irregularly maculate, surface only slightly uneven except for punctures. *Scutellum* small, triangular, with dense recumbent to subrecumbent whitish scales. *Elytra* with humeri slightly projecting anteriorly, with ca. 60° angle behind; 8th interval weakly projecting behind humeri; strial punctures moderate, round, moderately shallow, unevenly separated, each with a minute fine seta; intervals 1, 3, 5, and 7 convex, even intervals flat, all clothed densely with imbricate recumbent striate scales, odd intervals with dense uneven subrecumbent to suberect overlapping striate clavate scalelike setae; even intervals with similar setae, separated by 1 to 2 times their length. *Venter* coarsely punctate, densely clothed with imbricate recumbent striate scales, with sparse subrecumbent clavate scalelike setae; first suture weakly bisinuate; 5th segment very coarsely densely punctate, with a weak median apical depression. *Legs* with imbricate recumbent striate brown scales; femora subannulate with white scales; with short suberect clavate white and brown setae; corbel plate of third tibia glabrous. Tarsi sparsely pubescent ventrally. Length: 3.5 mm.

Holotype: female. MEXICO: State of Mexico, Pradera de [meadow of] Salazar, 17-II-1972, [ca. 2900 meters], under stones, C. W. O'Brien, Holotype [C.W.O'B.], 4 paratypes [C.W.O'B.] (2), [B.M.N.H.] (1), [M.H.N.M.] (1); 2 paratypes, same data, except collector P. Reyes C. [C.W.O'B.] (2).

This species is related to *mexicanus* and *spurcus* but the coarsely punctured apex of its rostrum is diagnostic. The scalelike setae of the odd intervals are denser and less even in this species than any other. Occasionally such setae are double. Its scutellum possesses scalelike setae while the others are glabrous.

ACKNOWLEDGEMENTS

I wish to thank Mr. R. T. Thompson of the British Museum of Natural History for the loan of Sharp's and Champion's type specimens; and Mr. Harry Howell, Jr. (Texas Tech University for the photos and E. M. Collins, Jr. (Florida Dept. Agr.) for his photographic assistance. I especially thank my friends, Dr. Terry Erwin, who gave me the type specimen of *championi*; Dr. John Lawrence, who presented me with the series of *mexicanus*; and Señores Pedro Reyes C. and Raul Muñiz V. who took me to the field and showed me the method of collecting which resulted in a series of *spurcus* and the 2 new species, *alternatus* and *undulatoides*.

Specimens are deposited in the following collections: [B.M.N.H.] British Museum of Natural History, London; [M.C.Z.] Museum of Comparative Zoology, Harvard University, Cambridge, Mass.; [C.W.O'B.] private collection, Charles W. O'Brien, Tallahassee, Florida; [R.M.V.C.] private collection, Raul Muñiz V., Ciudad de Mexico, Distrito Federal, Mexico; and [M.H.N.M.] Museo de Historia Natural de la Ciudad de Mexico, Distrito Federal, Mexico.

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CLASSIFICATION OF THE SPECIES OF THE *HARPALUS* SUBGENUS *GLANODES* CASEY (CARABIDAE: COLEOPTERA)[1]

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Abstract

The subgenus *Glanodes* is represented in the arid grasslands of southwestern United States, including Utah, Arizona, New Mexico, and western Texas by 6 species: *corpulentus* Casey, 1914; *puncticeps* Casey, 1914; *huachuca* NEW SPECIES (type locality: Huachuca Mts., Arizona); *stephani* NEW SPECIES (type locality: Arivaca, Arizona); *obliquus* Horn, 1880; and *cohni* NEW SPECIES (type locality: Marfa, Texas). Listed as a species inquirendum is *Glanodes regressus* Casey, 1914. The new name *Harpalus tadorcus* is proposed for *Harpalus cordatus* LeConte, 1853, a junior homonym of *H. cordatus* Duftschmid, 1812. The subgenus *Glanodes* and its included species are defined and described in terms of adult characteristics. A key is presented to the males of the species. The phylogeny and zoogeography of *Glanodes* is considered in relation to hypothetical transformation series of body structures, and in relation to the history of the arid grasslands in the southwest. It is proposed that the subgenus originated in the late Miocene in the area of the Colorado Plateau and spread south from there, with differentiation taking place when the grasslands contracted under the influence of unfavorable conditions leading to range disjunction of the habitat and of the *Glanodes* populations. Dispersal of the beetles occurred during periods favorable for expansion of the grasslands.

Introduction

The genus *Harpalus* is a large and varied group of mesophilous to xerophilous carabids, ranging in aggregate from southern Africa throughout the whole of the Palaearctic and Nearctic Regions except the arctic tundra. The genus is represented in temperate Mexico, south to the Trans-Volcanic Sierra in the vicinity of Mexico City. Most Nearctic species live in drier areas. On the whole, the taxonomy of North American species of *Harpalus* is not well worked out, although Lindroth (1968) provided a classification based on the Canadian-Alaskan fauna. I am extending Lindroth's study, and this paper deals with a minor but interesting portion of the genus.

In 1914, Casey erected *Glanodes* as a genus separate from, and not closely related to, *Harpalus*. In it he included 4 nominal species, 3 of them proposed as new, all from southwestern United States. One of these is of uncertain status. The others are probably valid species, but Casey did not prove it.

I first became interested in *Glanodes* in 1957 when I was working on another group of harpalines, the genus *Euryderus* LeConte. To determine the status of *Euryderus*, I wanted to know something about the other genera which clustered around *Harpalus*. Hence, I examined representa-

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tives of *Glanodes*—in fact, the types of the Casey species. At that time, I concluded 2 things: 1) *Glanodes* should be included in *Harpalus* as a subgenus; 2) *Glanodes* was probably monobasic. The first conclusion was published (Ball 1960a: 62), but the second one was not published.

In 1967, I returned to the study of *Harpalus*, specifically to the fauna of Mexico and southwestern United States, and determined to dispose of the *Glanodes* problem. By this time, I had collected a few specimens of my own on several expeditions to the southwest and also had borrowed types and additional material. Just enough material was available to convince me that my original estimate was in error; the group included more than 1 species, but I could not determine how many nor how they were distributed. So, the problem was left in abeyance. Additional specimens collected in 1967, 1969, and 1971 provided sufficient evidence to enable me to reach the conclusions given in this paper about the definition and classification of members of this subgenus.

ACKNOWLEDGEMENTS

I am grateful to the individuals and institutions listed in the materials and methods section for the loan of specimens essential to this study. Illustrations were prepared by J. S. Scott, of my Department. A preliminary draft of the manuscript was read and criticized by my colleagues D. R. Whitehead and G. R. Noonan.

MATERIAL

This study is based on examination of 137 adult specimens of *Glanodes*, including female specimens which could not be identified and the types of the nominal species. Specimens were borrowed from the following sources (indicated in the text by the abbreviations associated with them):

AMNH—American Museum of Natural History, New York City, N. Y. (Patricia Vaurie)
ANSP—Academy of Natural Sciences of Philadelphia, Philadelphia, Pa. (S. S. Roback)
CAS—California Academy of Sciences, San Francisco, California (Hugh B. Leech)
FMNH—Field Museum of Natural History, Chicago, Illinois (R. L. Wenzel)
MCZ—Museum of Comparative Zoology, Harvard University, Cambridge, Mass. (P. J. Darlington, Jr.)
NMNH—National Museum of Natural History, Washington, D. C. (R. Gordon)
OSUC—Ohio State University, Columbus, Ohio (C. A. Triplehorn)
TLE—Terry L. Erwin collection, National Museum of Natural History, Washington, D. C.
TTUL—Texas Technical University, Lubbock, Texas (C. W. O'Brien)
UASM—Strickland Museum, University of Alberta, Edmonton, Alberta, Canada
UCB—University of California, Berkeley, California (J. Chemsak)

UKL—Snow Entomological Museum, University of Kansas, Lawrence, Kansas (G. W. Byers)
KSC—Karl Stephan, 3038 E. Eastland, Tucson, Arizona

METHODS

Descriptions: Because members of this subgenus are all similar in external characteristics, species descriptions are brief. Characters common to all species are included in the description of the subgenus.

Analysis of variation: This was done for body length and for character of discriminatory value. Numerical data are presented in Tables 1 to 4. Standard statistics were computed for length and for 3 ratios, for those samples including 9 or more individuals. For samples of more than 1 but less than 9, only means were computed. Comparisons were made among larger samples by t- tests of mean differences. Some numerical data are presented in Graph 1.

Measurements: The following measurements were made with an ocular micrometer in a stereoscopic binocular microscope. The length represented by a micrometer scale interval at a magnification of 40X was 0.04mm.

Head length: straight-line distance from base of mandible to posterior margin of compound eye, on left side of head.

Pronotum length (PL): straight-line distance from apical to basal margin, measured along mid-line.

Elytra length (EL): straight-line distance from basal carina to apex of longer elytron.

"Standardized body length": sum of measurements described above. In my previous publications, I used the term "total length" for this sum, and hoped that other students of carabids would adopt this usage. This has not happened, and total length means different measurements to different workers. Therefore, I abandon the term "total length" for descriptive purposes and use the above designation in its place.

The following measurements (used to form ratios, as indicated in the text) of male genitalia parts are indicated on Fig. 4a and 4b: *Length of median lobe* (G: ML): straight-line distance from base to apex. *Length of apical portion of shaft* (G:MLAP): straight-line distance on dorsal surface from apex of membranous area to apex of median lobe. *Width of apex of median lobe* (G: MWA): straight-line distance across apex, measured on ventral aspect. *Length of macrospine V of internal sac* (G: ILV): straight-line distance from base to apex of macrospine V.

Illustrations: Line drawings were prepared with the aid of a camera lucida mounted on a Wild M5 stereoscopic microscope.

Recognition, grouping, and ranking: The identity of specimens was determined in part by study of the literature and in part by comparison with type specimens. The types of 3 nominal species are females which lack most or all distinctive characteristics of their respective species. Two were associated with their respective species by coincidence of geographical ranges. One type could not be so associated because its locality of collection is adjacent to the ranges of 3 species, and its name is assigned to the category "species inquirendum".

The categories used are species and subgenus. Because few specimens are available, it is impossible to be sure that character differences indicate real species differences. Of 6 species recognized, 3 have ranges which evidently partially overlap and are judged to be sympatric (Fig. 13). Males assigned to these species differ in details of the genitalia: form of apical portion of median lobe and proportions of larger spine of internal sac. It is assumed that discontinuities of this magnitude would not be observed among sympatric groups of males unless they represented reproductively isolated populations—hence different species. Allopatric males were judged conspecific if they exhibited substantial identity in genitalic characteristics. They were judged to be specifically different if they differed from one another as much as did the males of different sympatric species. This matter is discussed at greater length below. The decision to rank this complex of species as a subgenus is discussed below.

STRUCTURE OF THE MALE GENITALIA

Variation in the male genitalia cannot be accounted for in terms of differential growth related to body size (allometry) nor in terms of marked phenotypic variability. The first point was tested by plotting values for various ratios against body size; no correlations were discovered. The second point is best illustrated by noting the general similarity exhibited by the genitalia among groups of *H. obliquus* specimens from different areas (see Graph 1). If the genitalia were simply phenotypically highly plastic, one would expect marked differences between samples from geographically widely separated localities.

The median lobe: This is, in general, average for *Harpalus* specimens; it is an asymmetrical tube, sclerotized all around basally for about half its length, and throughout its length ventrally and on the right side; the membranous area is on the left side (Fig. 4a). The apical portion of the shaft (G: MLAP) is smooth or bears dorsally a series of short projections, called here spinules. The shaft terminates in a more or less expanded apical disc which projects ventrally as a short lip, and more or less dorsally as a pair of spinules referred to here as the discal spinules.

The parameres are typical of *Harpalus* members and do not offer characteristics of taxonomic value.

Structure and vestiture of the internal sac: The internal sacs of *Harpalus* males offer excellent characteristics for identification and classification of species, as shown by Lindroth (1968) for northern North American species, and as shown by Ball and Anderson (1962) for North American species of the subgenus *Pseudophonus*. However, a detailed system of homology and nomenclature of the various structures for the entire genus has not been proposed. I have prepared such a system, and it will be published in the near future. This system is used here to designate the parts of the internal sac of *Glanodes* males.

The following description should be studied in conjunction with Fig. 4 to 11. The aspects of the internal sacs illustrated are lateral, left or right, with the apex of the median lobe directed toward the upper margin of the page. Surfaces are designated as follows. The dorsal side is toward the bottom of the page, ventral toward the top. Sides are designated according to the position of the everted median lobe relative to the long axis of a beetle; the left side of the internal sac corresponds to the left side of the median lobe when the latter is everted. The basal area of the internal sac is near its point of attachment to the median lobe, the medial area is toward the middle, and the preapical area is toward the distal end of the everted sac.

Briefly, the internal sac of a *Glanodes* male exhibits the following features: a large lobe on the left side (not evident in the illustrations); 2 large spines, named macrospines, and designated by roman numerals (IV, on right side basally, and V, approximately medio-dorsal); 1 to 3 patches of somewhat enlarged scales, named macrotrichia and designated by capital letters (C basal ventral; F, medial left; H, medial right (Fig. 11c)). Macrotrichial fields C and F exhibit variation in number of macrotrichia, and are absent from the internal sacs of some specimens.

SPECIES DISCRIMINATION

As indicated above, the major evidence for recognition of *Glanodes* species is the pattern of geographical variation of the male genitalia. The following discussion is based on data presented in Graph 1. This is a scatter diagram, with values for the ratio G: ILV/ML plotted against values for the ratio G: MWA/MLAP, for each individual measured. The lines around groups of specimens do not imply boundaries, but facilitate recognition of the major groups.

The variation pattern is not the simple one which might be expected if there were gene flow among adjacent population samples. Note these 5 points:

1) The groups with the highest values for the ratio G: ILV/ML are *H. cohni* and *H. puncticeps*. The former group is known only from western Texas (Fig. 13), the latter only from northwestern Arizona, and between them are the ranges of *H. obliquus* and *H. stephani*.

2) The groups with the lowest values for this ratio are *H. huachuca* and *H. corpulentus*, with the former occurring in southern Arizona, the latter in Utah, and with the ranges of *H. puncticeps*, *H. stephani* and *H. obliquus* in between.

3) The ranges of *H. huachuca* and *H. obliquus* overlap in the Huachuca Mountains, but the 2 groups are widely separated, mainly by differences in the values for the ratio G: MWA/MLAP.

4) The Arivaca specimen of *stephani* (coordinates G: ILV/ML-0.25, and G: MWA/MLAP-0.44) approaches the *H. huachuca* specimen very little more than does one of the Baboquivari specimens (coordinates 0.27 and 0.47), although Arivaca is geographically closer to the Huachuca Mountains than are the Baboquivari Mountains. If there were gene flow among these groups, one would expect the Arivaca specimen to occupy an intermediate position between the other 2 groups.

5) The geographical range of *H. cohni* and *H. stephani* approach one another, but the Texas specimen of the latter species (labelled "T" in Graph 1) shows no tendency to be *cohni*-like.

In summary, the data indicate that the variation pattern of these characteristics is not closely correlated with geography. The geographical proximity of 3 of these groups, without clear indication of intermediacy in genitalic characteristics, suggests that genetic interaction is not taking place among the groups. A conclusion seems clearly indicated:

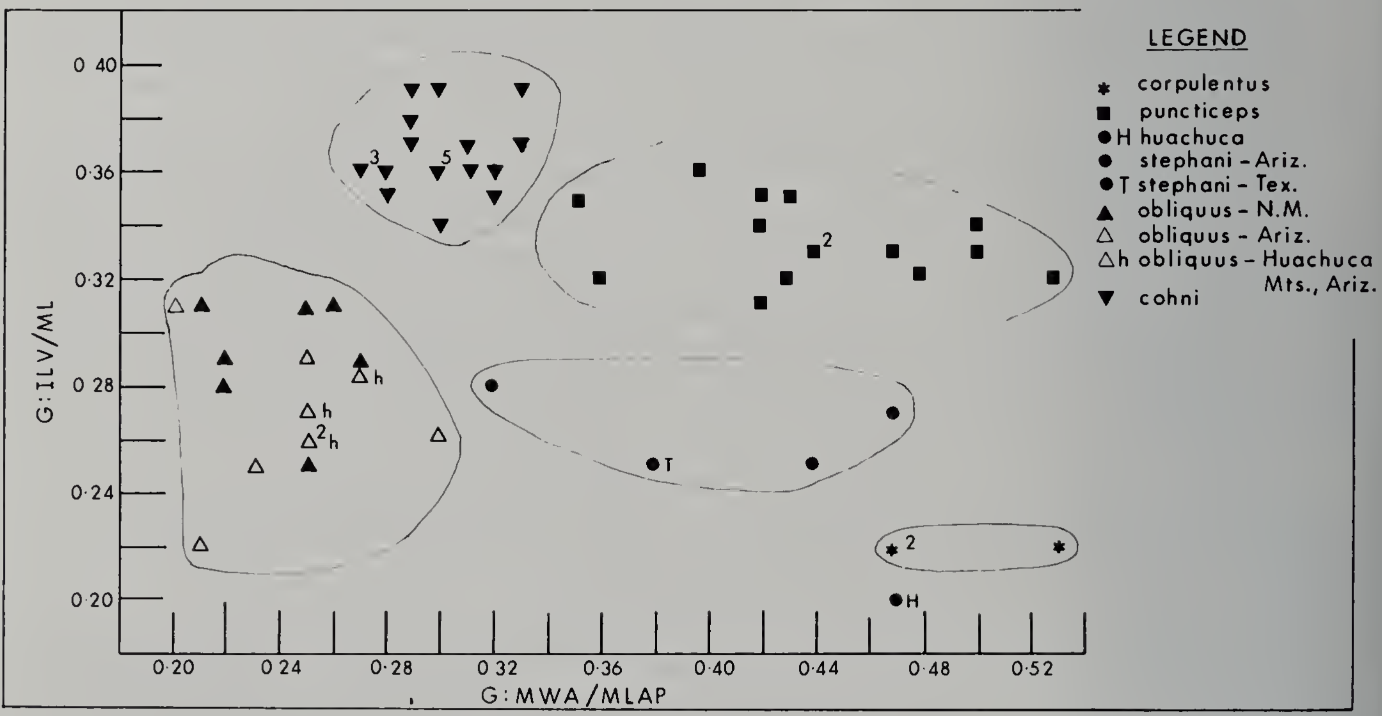
the differences in genitalia are evidence that the different groups are specifically distinct. This conclusion is borne out by additional features of the genitalia as well as by a few external structural characteristics.

RANKING AND RELATIONSHIPS OF *Glanodes*

The evidence that *Glanodes* is monophyletic, and thus a natural group, is a unique combination of characteristics shared by its members. These characteristics are detailed in the section entitled "diagnostic characteristics". It is not possible at this time to show by phylogenetic interpretation of the data that *Glanodes* should be included in *Harpalus*, but on the basis of phenetic considerations it clearly belongs therein. Although the combination of characteristics is unique, each characteristic itself is within the range of variation of *Harpalus sensu latiore.*

To more closely approximate the numerous important phylogenetic branchings within a genus with the diversity of *Harpalus,* I think it essential to have several infrageneric ranks. For instance, I use the formal category subgenus and semi-formal "group" and "subgroup". My notion of "subgenus" as a taxon is of a group generally equivalent to, or rarely more inclusive than, Lindroth's (1968) "group". The *Glanodes* taxa are not sufficiently different among themselves to warrant introduction of semi-formal categories, although it is necessary to have them for other subgenera of *Harpalus.*

Relationships at the subgeneric level are not clear at present. Members of this subgenus superficially resemble those of *Opadius,* but the internal sacs of the latter are characterized as follows: ventral lobe with spine patch; with macrospines I and VIII. Thus, there is no detailed similarity between *Opadius* and *Glanodes* internal sacs. An enlarged ventral lobe with spine patches seems to characterize the more highly evolved subgenera of *Harpalus,* and I think it is possible that *Glanodes* shared a common ancestry with the ancestors of the former complex.



GRAPH 1: Diagram illustrating correlation of values for ratios G: ILV/ML and G: MWA/MLAP, for *Glanodes* specimens.

Classification

Subgenus *Glanodes* Casey

Glanodes Casey, 1914: 60. TYPE SPECIES: *Harpalus obliquus* Horn (type by original designation).
Harpalus (*Glanodes*) Csiki, 1932: 1185; Ball, 1960a: 62, and 1960b: 140; Lindroth, 1968: 809.

Diagnostic characteristics: Members of this subgenus most closely resemble those of *Harpalus* (*Opadius*) *tadorcus* NEW NAME[1], but differences in form of the pronotum distinguish the 2 groups readily: *Glanodes* specimens with sides oblique posteriorly, not sinuate; *Opadius* specimens with sides sinuate posteriorly. Lindroth (1968: 809) wrote that these 2 groups were closely related because, in addition to other shared characteristics, the males of each have 2 spines in the internal sac of the genitalia. However, study of the everted internal sac shows that the spines are probably not homologous because they are not in the same relative positions in the members of the 2 taxa.

Head with dorsum punctate between and behind eyes. Elytra posteriorly with ocellate punctures in intervals 5 and 7, and in interval 3 of most specimens; each with single discal seta in or near stria 2. Abdominal sterna 3 to 5 with accessory setae. Tarsal articles with dorsal surfaces glabrous. Mentum edentate. Pronotum with hind angles obtuse, subangulate or broadly rounded; posterior lateral impressions finely punctate. Metepisterna short. Elytra with apices average, not markedly sinuate. Hind wings short stubs. Male genitalia with median lobe average in form and proportions. Internal sac with large left lobe. Macrospines IV and V present, V very large; no spine patches; macrotrichial field H present, fields C and F present or absent (Fig. 4a, 5a, 7a,b, 8, 9a, 11a,c). Sclerites of ovipositor average.

Description: Size average for *Harpalus*, standardized body length of males within 6.5 to 10.5 mm (details in Table 1); females approximately same size.

Form: subpedunculate; proportions average (Fig. 12), but body more terete than average.

Color: Body with dorsum rufo—piceous to piceous, almost black in some specimens; venter rufous to rufo- piceous. Antennae, palpi, and legs rufous.

Microsculpture: Labrum, meshes isodiametric, lines distinct. Clypeus and dorsum of head of female with meshes small, isodiametric, lines fine; male, with lines almost effaced, meshes small, isodiametric or slightly stretched; ventral surface of head with lines more or less effaced medially, distinct laterally, meshes isodiametric. Pronotum of females with lines fine, meshes small, stretched, except isodiametric near and in posterior-lateral impressions; among males, meshes indistinct to effaced, generally effaced medially. Proepisterna with meshes stretched longitudinally, lines distinct; Prosternum with lines fine, meshes stretched transversely.

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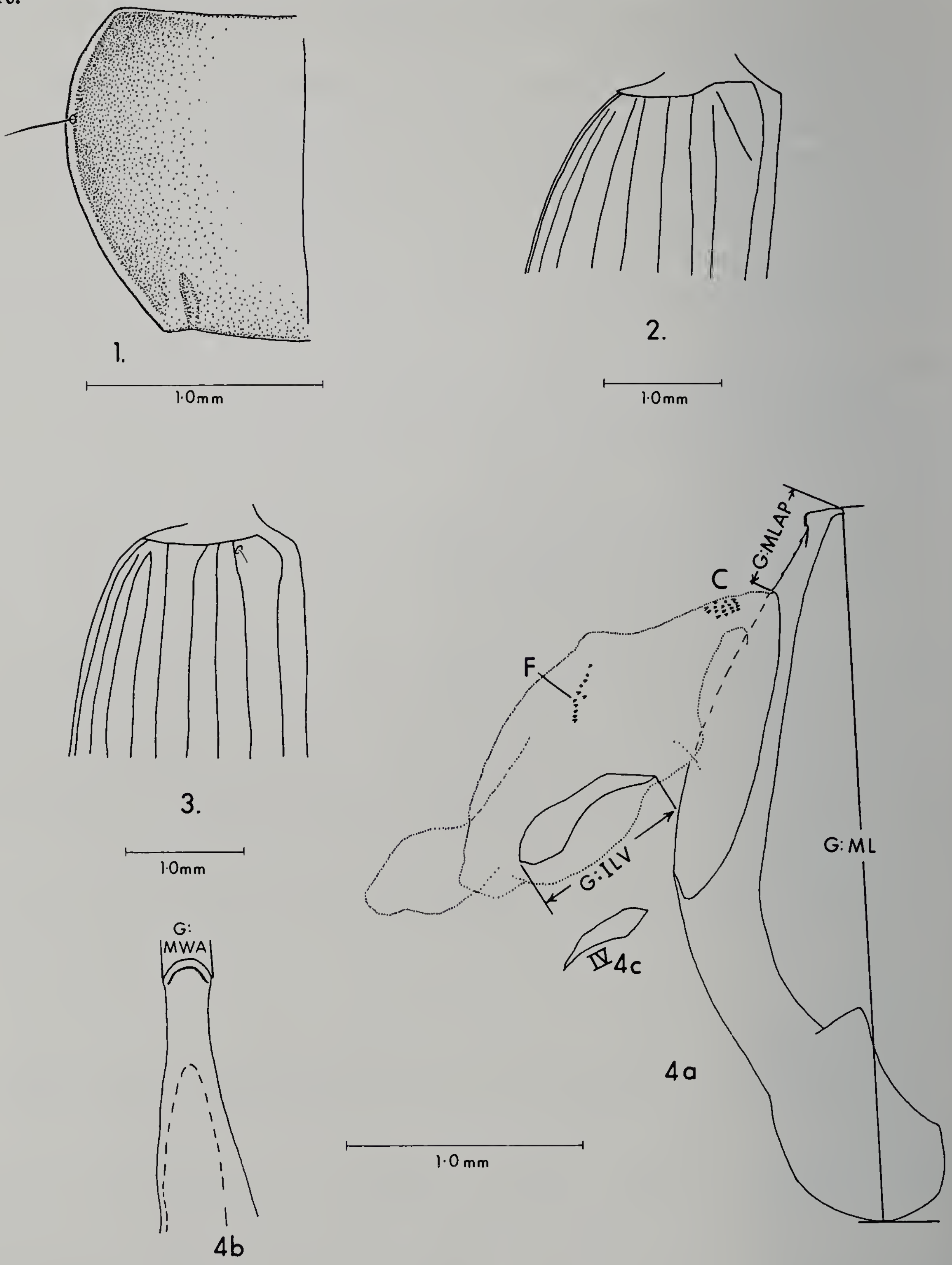
[1] Proposed for *Harpalus cordatus* LeConte, 1853, junior secondary homonym of *Harpalus* (*Ophonus*) *cordatus* Duftschmid, 1812. The specific epithet *tadorcus* is an anagram based on *cordatus*.

Metepisterna and lateral areas of metasternum with lines distinct, meshes slightly stretched; middle of metasternum smooth. Elytra with meshes isodiametric, lines distinct; or meshes stretched, lines very shallow to absent.



1) Pronotum, left half, of *Harpalus stephani*, new species (Baboquivari Mountains, Arizona). 2) Left elytron, basal portion, of *Harpalus puncticeps* Casey (Peach Springs, Arizona). 3) Left elytron, basal portion, of *Harpalus obliquus* Horn (Fort Bayard, New Mexico). 4) Male genitalia of *Harpalus corpulentus* Casey (Wasatch, Utah): a, median lobe and everted internal sac, left lateral aspect; b, median lobe, apical portion of shaft, ventral aspect; c, macrospine IV. Lettering: C and F, macrotrichial fields of internal sac; IV and V, macrospines of internal sac; G: ML- length of median lobe; G: MLAP-length of apical portion of shaft of median lobe; G: ILV- length of macrospine V; G: MWA- width of apex of median lobe, in ventral aspect.

Luster: Dull to shining; ventral surface among most specimens more shining than dorsal surface; no parts of body iridescent.

Macrosculpture: Dorsum of head with coarse punctures, more or less

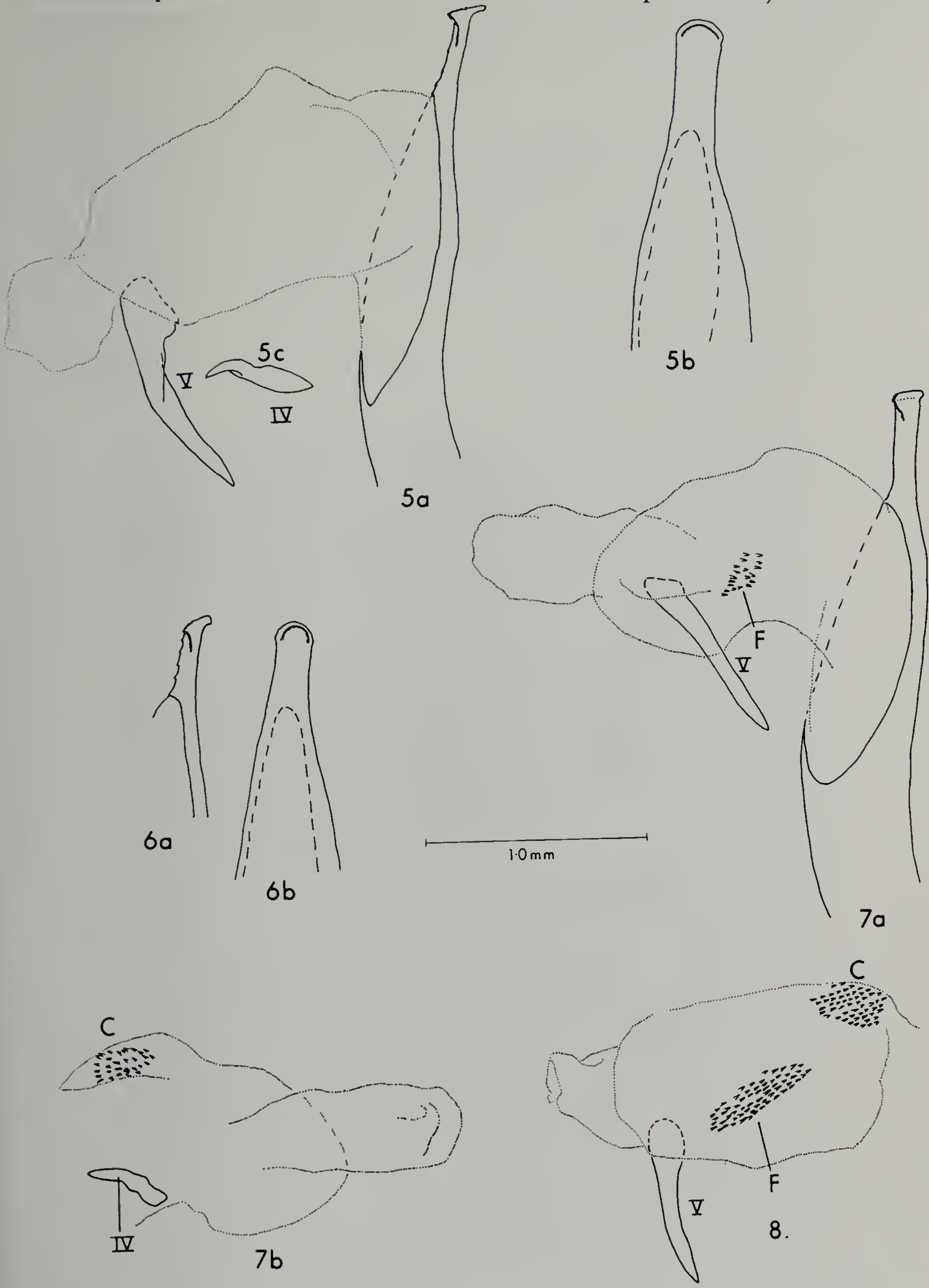


Fig. 5-8. Male genitalia of: 5) *Harpalus puncticeps* Casey (Peach Springs, Arizona) : a, b, c and lettering as in Fig. 4; 6) *Harpalus huachuca*, new species (Huachuca Mountains, Arizona) : a, median lobe, apical portion of shaft, left lateral aspect; b, median lobe, apical portion of shaft, ventral aspect; 7) *Harpalus stephani*, new species (Baboquivari Mountains, Arizona) : a, median lobe, apical portion of shaft and everted internal sac, left lateral aspect; b, internal sac, right lateral aspect. Lettering as in Fig. 4; 8) internal sac, left lateral aspect, of *Harpalus stephani*, new species (Culberson County, Texas). Lettering as in Fig. 4.

deeply impressed. Pronotum with posterior lateral impressions and lateral grooves sparsely, finely punctate.

Vestiture: Submentum with 2 pairs setae, mentum with 1 pair setae. Prosternum with numerous short, fine setae on basal portion; apex of in-

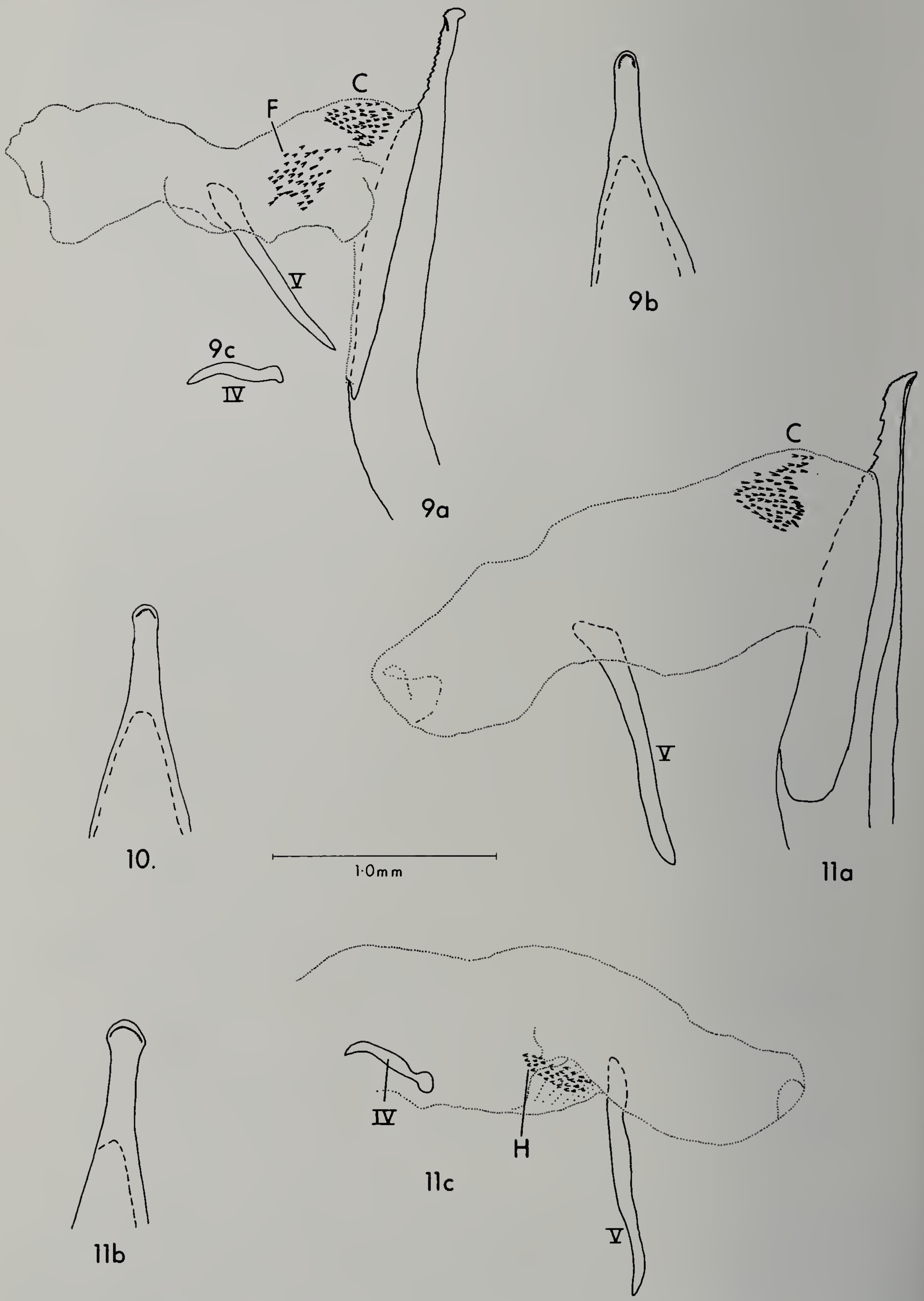


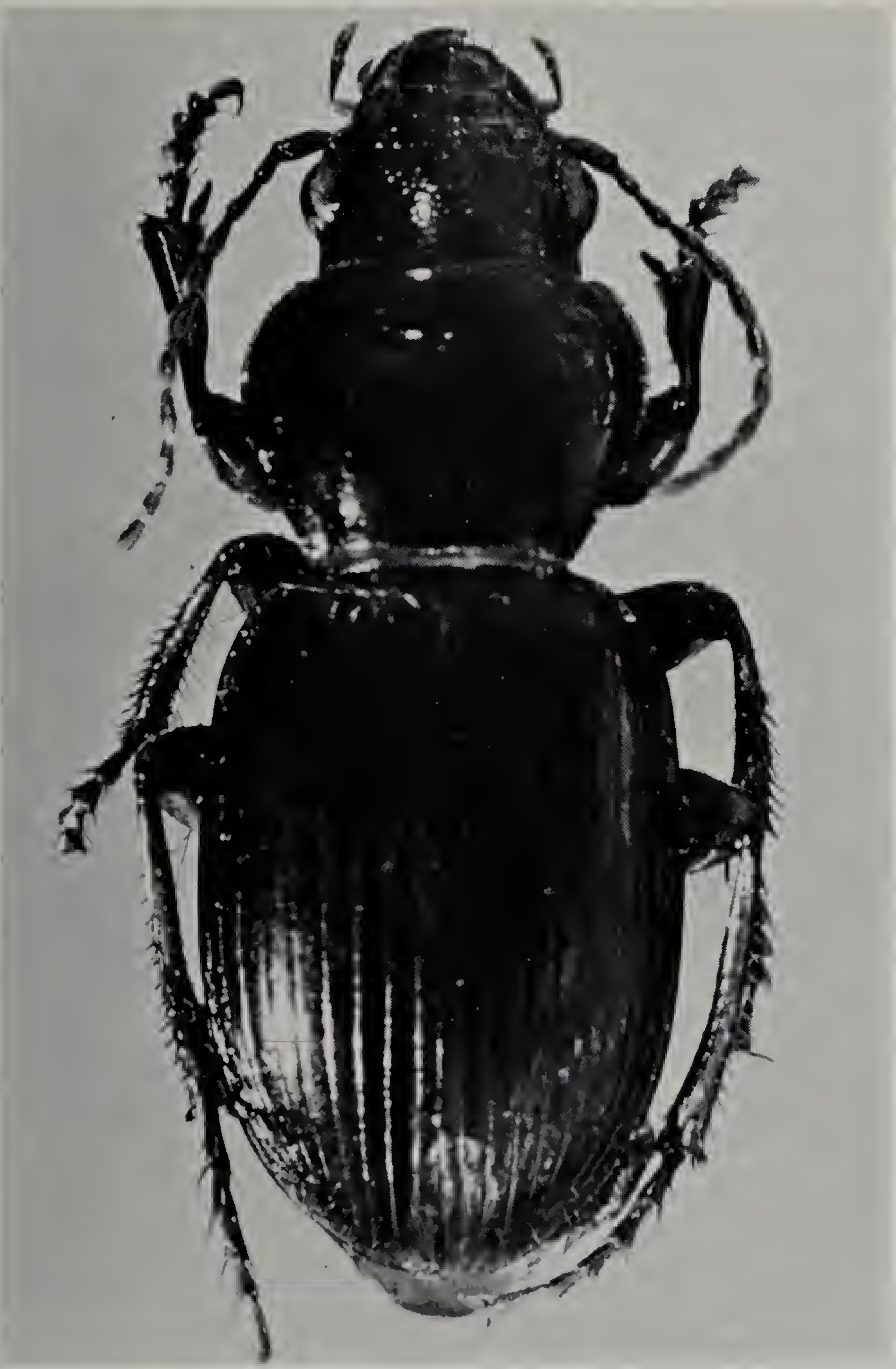
Fig. 9-11 Male genitalia of: 9) *Harpalus obliquus* Horn (Huachuca Mountains, Arizona): a, b, c and lettering as in Fig. 4; 10) median lobe, apical portion of shaft, ventral aspect, of *Harpalus obliquus* Horn (41 mi. sw. Magdalena, New Mexico); 11) of *Harpalus cohni*, new species (Davis Mountains, Texas): a and b as in Fig. 4; c, internal sac, everted, other lettering as in Fig. 4.

tercoxal process with row of setae. Metasternum with row of setae. Middle coxae setose; hind coxae each with 4 to 6 setae; each femur with several rows of long setae. Each elytron with basal area with short fine setae, each side of scutellum; basal puncture; single discal puncture on or near stria 2; intervals 3, 5, and 7 with several setigerous punctures in apical 1/5. Abdominal sterna 3, 4, and 5 with accessory setae; sternum 6 with 4 long terminal setae.

Head: Average for *Harpalus.* Frontal impressions broad, irregular depressions. Antennae extended posteriorly to base of pronotum; scape slightly swollen near base.

Mouthparts: Labrum, mandibles, and maxillae average. Labium with paraglossae slightly longer than, and adnate almost to apex of, ligular sclerite.

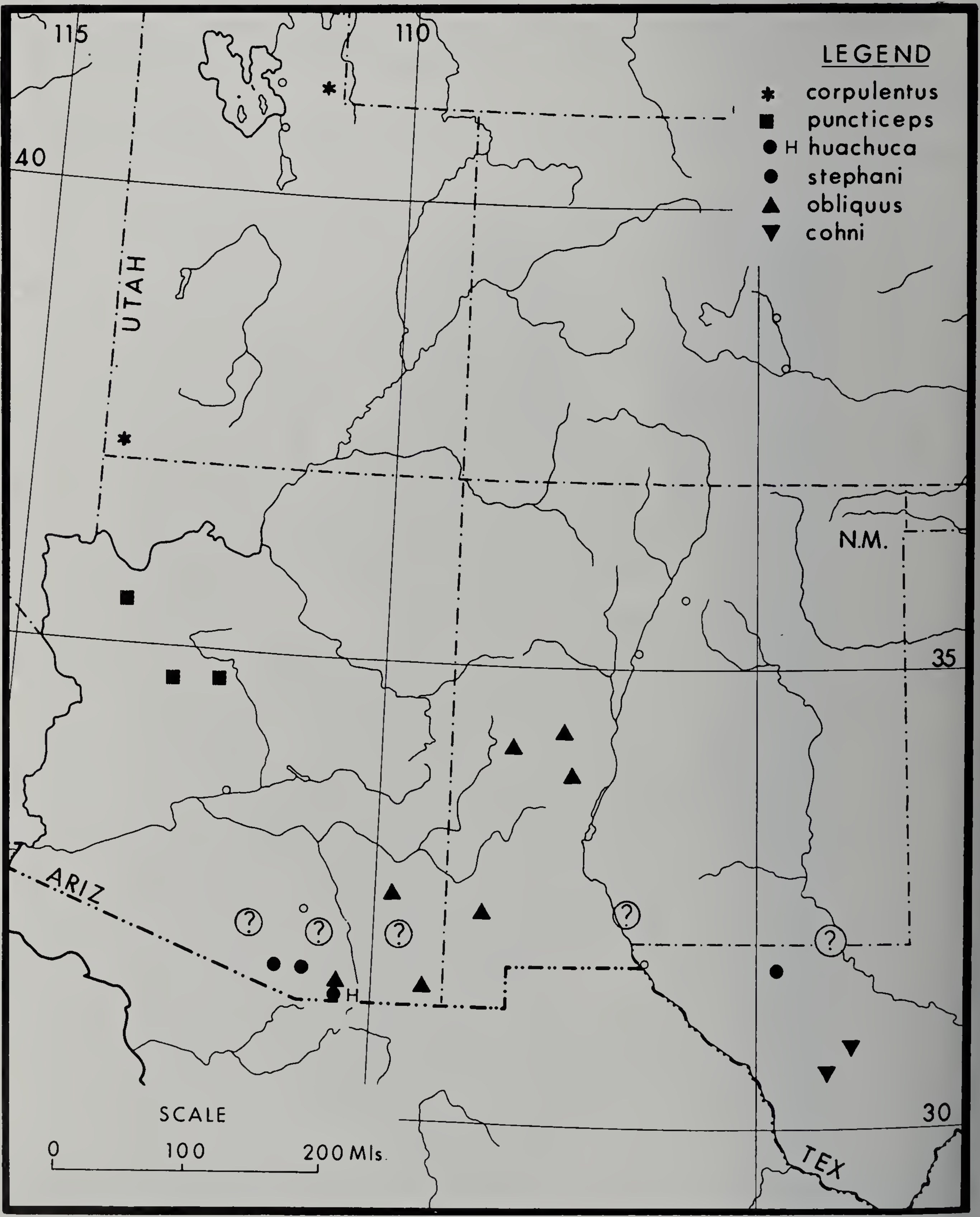
Prothorax: Pronotum (Fig. 1) markedly convex, cordiform; anterior margin almost straight; posterior margin straight or slightly bisinuate



12. Photograph of dorsal surface of male *Harpalus obliquus* Horn (41 mi. sw. Magdalena, New Mexico).

laterally; sides rounded, more strongly constricted posteriorly than anteriorly. Anterior lateral angles rounded, hardly projected; posterior lateal angles rounded, projected slightly posteriorly. Transverse impressions absent; median longitudinal impression shallow; lateral grooves moderately wide, sides more or less distinctly beaded; posterior lateral impressions moderately elongate, shallow. Prosternum with apex of intercoxal process beaded or not.

Pterothorax: Metasternum reduced. Metepisternum as long as wide, about twice as long as metepimeron.



13. Map of southwestern United States, showing distribution of the species of subgenus *Glanodes*. Question marks indicate localities at which unidentified females were collected.

Elytra: Widened gradually to apical 2/5, evenly tapered or slightly sinuate subapically; humeri rounded or angulate. Striae well developed, shallowly punctate; intervals moderately convex.

Hind wings: Short stubs.

Legs: Average for *Harpalus* members, except as noted in diagnosis. Front and middle tarsi of males with articles 1 to 4 with adhesive hairs on ventral surfaces.

Male genitalia: Median lobe average in form and proportions. Internal sac as described in diagnosis, and as figured (Fig. 4 to 11).

Female genitalia and *ovipositor*: Average for members of Harpali.

Geographical distribution: The subgenus *Glanodes* is known from southwestern United States, ranging from the Mexican border northward to northern Utah, and from western Texas to northwestern Arizona. The species are evidently confined to grassland and desert grassland habitats.

KEY TO MALES OF THE SPECIES OF THE SUBGENUS *Glanodes*

1. Elytron with well developed humeral tooth .... 2.

1′. Elytron without humeral tooth, humerus rounded (Fig. 3 and 12) .... 3.

2(1). Male genitalia with macrospine V of internal sac shorter (Fig. 4a); with macrotrichial field C; specimen from locality north of Grand Canyon, in Arizona or Utah .... *corpulentus* Casey, p. 189.

2′. Macrospine V longer (Fig. 5a); without macrotrichial field C; specimen from locality south of Grand Canyon .... *puncticeps* Casey, p. 190.

3(1). Elytral intervals smooth, lines of microsculpture absent or confined to edges of striae; median lobe of genitalia with broad apex (Fig. 11b); specimen from western Texas locality .... *cohni* new species, p. 193.

3′. Elytra with microsculpture lines evident on elytral intervals, meshes isodiametric or transversely stretched .... 4.

4(3). Median lobe with apex narrow in ventral aspect (Fig. 9b and 10) .... *obliquus* Horn, p. 192.

4′. Median lobe with broader apex (Fig. 5b and 6b) .... 5.

5(4). Median lobe with apical portion of shaft smooth dorsally (Fig. 7a); apex viewed in lateral aspect about truncate .... *stephani* new species, p. 192.

5′. Median lobe with apical portion of shaft with spinules dorsally (Fig. 5a and 6a) .... 6.

6(5). Internal sac with macrospine V long (Fig. 5a) .... *puncticeps* Casey, p. 190.

6′. Internal sac with macrospine V short (Fig. 4a) .... *huachuca* new species, p. 191.

Harpalus (*Glanodes*) *corpulentus* Casey

Glanodes corpulentus Casey, 1914: 62. HOLOTYPE female, labelled as follows: "Virg. R. Ut; Casey bequest 1925; TYPE USNM 47736 [red paper]. TYPE LOCALITY—St. George, Utah (here restricted) (NMNH).

Note on type locality: The restriction of the type locality is made to provide a specific place. The restriction is based on study of specimens compared with the type, each bearing a "St. George" locality label, with style of printing similar to that of the locality label of the type specimen. Indeed, I suspect that the type specimen was probably collected at St. George.

Comparisons: In external features, specimens of this species are most like those of *H. puncticeps*. However, the median lobe of *H. corpulentus* is shorter, with shorter apical portion of the shaft and narrower apex, and with macrospine V of the internal sac shorter (Tables 3 and 4, Fig. 4 and 5). In proportions of the genitalia, males of this species are most like those of *H. huachuca*, but the median lobe of the latter is shorter with shorter apical portion and with shorter macrospine V. Further, the known ranges of these taxa are widely separated (Tables 3 and 4, Fig. 4, 6, and 12).

Description: Data on variation in standardized body length, and in the ratios PL/EL, G: MWA/MLAP and G: ILV/ML are presented in Tables 1 to 4. Variation in the last 2 ratios is correlated in Graph 1. Elytra of males with well developed microsculpture lines, meshes small, isodiametric or slightly stretched; humeri narrowly rounded, each with well developed tooth (cf. Fig. 2), latter smaller than in *puncticeps* males. Median lobe shorter than average, apical portion of shaft short (G: MLAP), dorsally with short spinules; disc well developed, apex oblique, discal spinules well developed (Fig. 4a); apical disc broad (Fig. 4b). Internal sac with microspine V short (Fig. 4a) (G: MWA); macrotrichial field C small, field F very small (Fig. 4a); 3 males dissected.

Geographical distribution: known only from Utah (Fig. 13).

Material examined: 8 specimens from UTAH: Summit County, Wasatch (OSUC); Washington County, St. George (AMNH), Virgin River (MCZ). "Utah". (NMNH).

Harpalus (*Glanodes*) *puncticeps* Casey

Glanodes puncticeps Casey, 1914: 61. HOLOTYPE female, labelled as follows: "Peach Sp'g Arizona Wickham; 1 1 23; Casey bequest 1925; TYPE USNM 47735 [red paper]. (NMNH) TYPE LOCALITY—Peach Springs, Mohave County, Arizona.

Comparisons: Specimens of this species are most like those of *H. corpulentus* in external characters (for details, see discussion of the characteristics of the latter species above). In genitalic characteristics, males of *H. puncticeps* have a long macrospine V, like males of *H. cohni*, and a moderately long apical portion of the shaft as in *H. stephani* males. However, the combination of ratios G: MWA/MLAP and G: ILV/ML distinguish them (Graph 1 and Tables 3 and 4).

Description: Data on variation in standardized body length, and in the ratios PL/El, G: MWA/MLAP, and G: ILV/ML are presented in Tables 1 to 4. Variation in the last 2 ratios is correlated in Graph 1. Elytra of males with well developed microsculpture lines, meshes isodiametric or slightly stretched; humeri of most males each with well developed tooth (Fig. 2), of most females not toothed (Fig. 3). Median lobe longer than average, apical portion of shaft of average length with small spinules throughout length dorsally; apical disc well developed, with well developed discal spinules (Fig. 5a), broad in ventral aspect (Fig. 5b). Internal sac with macrospine V longer than average; macrotrichial fields C and F various: both lacking (11 specimens), C very small, F lacking (2 specimens), or both small (1 specimen). I dissected 15 males.

Notes on habitat: Specimens were collected on 10-VIII-71, 19 miles south of Frazier's Well, Hualapai Indian Reservation, Arizona, in grassland areas, mainly on flood-plains. Vegetation consisted of grasses, cacti, and small piñon oaks (mainly on the edges of small arroyos). The ground was clay with gravel mixed in, and with stones on the surface. The ground was damp and a nearby arroyo had recently been full of water. The beetles were under dry cattle and horse droppings, under stones, and in piles of plant debris concentrated in lumps by the action of flood water. Other carabids collected in the same area represented the following genera: *Pterostichus* (subgenus *Poecilus*), *Agonum*, *Piosoma*, *Harpalus*, *Selenophorus*, *Discoderus*, and *Bradycellus*.

Specimens of *Harpalus puncticeps* were also collected near Paulden, Arizona on a slope near a small creek, following a very heavy rain. The vegetation was very sparse, including grasses and cacti. The beetles were under dry cattle and horse droppings. Other genera represented were those listed above minus *Bradycellus* and including *Calosoma* and *Stenolophus* (*conjunctus* group). All specimens for which data are available were collected in August, at elevations greater than 5000′ above sea level.

Geographical distribution: known only from grassland areas in northwestern Arizona (Fig. 13).

Material examined: I examined 40 specimens from the following localities in ARIZONA: Coconino County, 19 mi. s. Frazier's Well, about 7 mi. e. Peach Springs, 5300-5400′ (UASM); Mohave County, Peach Springs (NMNH); Hualapai Indian Reservation, Buck and Doe Road, 12.2 mi. n. jct. with U.S. 66, 2.6 mi. e. Peach Springs, 11-VIII-71, 5100′ (UASM); Yavapai County, Grasshopper Flat (UAT); 1.3 mi. s. Paulden, on U.S. 89 (UASM).

Harpalus (*Glanodes*) *huachuca* Ball, NEW SPECIES

Comparisons: In external characteristics males of this species are indistinguishable from males of *H. stephani*. However the 2 groups of specimens are distinguished by differences in the male genitalia (Fig. 6, cf. Fig. 7). The median lobe of the *H. huachuca* male is much shorter, with shorter apical portion of shaft, narrower apical disc, shorter macrospine V of the internal sac and with smaller macrotrichial field C (Tables 3 and 4 and Graph 1).

Description: Values for the following measurements and ratios are presented in Tables 1 to 4: standardized body length, PL/EL, G: MWA/MLAP and G: ILV/ML. Variation in the last 2 ratios is correlated in Graph 1. Elytra of male with well developed microsculpture, meshes isodiametric or slightly stretched; humeri not toothed (cf. Fig. 3). Median lobe shorter than average, apical portion of shaft short with short spinules dorsally throughout length; apical disc oblique, large, discal spinules prominent (Fig. 6a), broad in ventral aspect (Fig. 6b). Internal sac with macrospine V shorter than average, macrotrichial field C very small, field F small.

Type material: HOLOTYPE male, labelled "Huachuca Mts., Ariz. VIII. 10" [handwritten]; (NMNH). The type locality should be more restricted than the mountain range listed above, but this cannot be done until additional material is found in the vicinity of the Huachuca Mountains. No biological data are available.

Derivation of the specific epithet: the name of the type area, treated as a noun in apposition.

Geographical relationships: The known range is partially within the known range of *H. obliquus*, and probably within the range of *H. stephani* (Fig. 13).

Harpalus (*Glanodes*) *stephani* Ball, New Species

Comparisons: The absence of spinules from the apical portion of the shaft of the median lobe distinguishes the males of this species from all others of *Glanodes*.

Description: Values for the following measurements and ratios are presented in Table 1 to 4: standardized body length; PL/EL; G: MWA/MLAP and G: ILV/ML. Variation in the last 2 ratios is correlated in Graph 1. Pronotum in form as in Fig. 1.

Elytra of males with microsculpture lines well developed, meshes isodiametric or slightly stretched; humeri not toothed. Median lobe straighter than average, apical portion of average length, without spinules dorsally; apical disc well developed, subtruncate apically, with well developed discal spinules (Fig. 7a). Internal sac with macrospine V short, macrotrichial field C large, field F large (Fig. 8) or small (Baboquivari Mts. specimen Fig. 7a).

Type material: Holotype male, labelled: "Arizona Pima County, Arivaca, 8 Sept. 1970, K. Stephan coll." (NMNH). Paratypes: 3 males, Baboquivari Mts., 24-VII-41, R. H. Beamer (UKL); same. E. L. Todd (UKL); Culberson Co., Texas, 12-VII-27, L. A. Stephenson (UKL).

Derivation of specific epithet: named after Karl Stephan, an accomplished amateur coleopterist who collected the holotype.

Notes on habitat: The type locality is in an area of desert grassland. I visited it, but failed to obtain specimens of this species.

Geographical relationships: The range partially overlaps that of *H. obliquus*, probably also that of *H. huachuca*, and possibly that of *H. cohni*. However, no instance of sympatry involving this species is known.

Geographical distribution: from western Texas to south-central Arizona (Fig. 13).

Harpalus (*Glanodes*) *obliquus* Horn

Harpalus obliquus Horn, 1889: 140. Type male, labelled as follows: "N.M.; LectoTYPE 2950 [red paper]; *H. obliquus* Horn" (ANSP). TYPE LOCALITY—Bayard, New Mexico (as indicated in original description).—Lindroth, 1968: 809.
Glanodes obliquus (Horn), Casey, 1914: 61.

Comparisons: The external characteristics of reduced elytral microsculpture and rounded humeri are sufficient to distinguish males of this species from other *Glanodes* males. The very narrow apical portion of the shaft, narrow apical disc, and large macrotrichial field F distinguish the male genitalia of this species from those of the closely related *H. cohni*.

Description: A specimen is illustrated in Fig. 12. Data on variation in standardized body length and in the ratios PL/EL, G: MWA/MLAP and G: ILV/ML are presented in Tables 1 to 4. Variation in the last 2 ratios is correlated in Graph 1. Elytra of males with microsculpture lines various: very fine, meshes broader than average, distinctly stretched transversely or lines of average depth and meshes approximately isodiametric; humeri not toothed (Fig. 3). Median lobe shorter than average, apical portion of shaft dorsally with numerous spinules throughout length, of average length; apical disc small, apex oblique, discal spinules well developed (Fig. 9a); apex narrow (Figs. 9b and 10). Internal sac with macrospine V slightly longer than average, macrotichial fields C and F large (Fig. 9a); 17 specimens were dissected.

Notes on habitat: I collected specimens on the San Augustin Plains of New Mexico, 40 miles from Magdalena at 7350′ above sea level, in grassland, adjacent to a wash which had recently been flooded. The soil was clay, reddish or gray in color, with stones on the surface. The beetles were found under cattle droppings and under stones where the soil was damp. Elsewhere the soil was very dry. Additional species represented there were: *Calosoma* (2 species); *Pasimachus californicus* Chaudoir; several species of *Bembidion*; *Agonum placidum* Say; 2 species of *Amara*; 8 harpalines, including *Piosoma setosum* LeConte, *Harpalus pensylvanicus* De Geer, *H. tadorcus* Ball, *H. amputatus* Say, a species of the *H. fraternus* group, 2 species of the *H. desertus* group, and 2 species of *Discoderus*; and 1 species of *Cymindis*. I did not see any especially distinctive features of the habitat, other than that the land was fairly well drained. It seemed to me that if *obliquus* specimens could live here, they could live anywhere on the San Augustin Plains.

Geographical relationships: The range includes that of *H. huachuca*, and probably, much of the range of *H. stephani*. However, it has yet to be established that *H. obliquus* populations are microsympatric with the populations of these other species.

Geographical distribution: known from western New Mexico and southeastern to south-central Arizona (Fig. 13).

Material examined: 35 specimens from the following localities:

ARIZONA: Cochise County: Chiricahua Mts., 14-IX-38 (OSUC); Hereford, 28-VII-07 (OSUC); Huachuca Mts. (AMNH, NMNH, OSUC); Webb (CAS). Graham County: Fort Grant (NMNH); Stockton Pass, Pinaleño Mts., 12-VIII-54 (UAT).

NEW MEXICO: Catron County: Rte. 78, 12.3 mi. nw. Beaverhead, 13-*IX*-67 7140′ (UASM); Rte. 78, 76 mi. sw. Magdalena, 17-VIII-69 (UASM). Grant County: Silver City, V. 13 (MCZ). Socorro County: "Socorro Co." (UKL); Magdalena, 18-VIII-94 (UKL); Magdalena Mts. VIII-94 (UKL); Rte. 78, 40.4 mi. sw. Magdalena, 7350′, 17-VIII-69 (UASM).

Harpalus (*Glanodes*) *cohni* Ball, NEW SPECIES

Comparisons: Males of this species are easily distinguished from other *Glanodes* males by the shining elytra whose intervals lack microsculpture. The elytra of *cohni* males are on the average relatively shorter; thus, the mean values for the ratio PL/EL are slightly higher than those of samples of other *Glanodes* males (see Table 2). The genitalia are markedly distinctive, with a reduced apical disc, large dorsal spinules, and elongate macrospine V (Fig. 11a and 11b). The mean differences between the population samples of this species and the Fraziers' Well sample of *H. puncticeps* are statistically significant, and the difference in the means of the ratio G: MWA/MLAP is taxonomically significant (Tables 3 and 4).

Description: Data on variation in standardized body length and in the ratios PL/EL, G: MWA/MLAP and G: ILV/ML are presented in Tables 1 to 4. Variation in the last 2 ratios is correlated in Graph 1. Elytra of males shining, with microsculpture lines very faint, confined to striae; humeri not toothed. Median lobe elongate; apical portion of shaft elongate, dorsally with longer than average spinules; apical disc oblique, small, without discal spinules (Fig. 11a); apex broad (Fig. 11b). Internal sac with macrospine V long; macrotrichial field C large, field F absent (Fig. 11a); 23 males were dissected.

Type material: HOLOTYPE male and ALLOTYPE female labelled: "Marfa, Texas, VII. 12, J. W. Green collector; J. W. Green collection" (CAS). PARATYPES: 36 males, 16 females, from the following TEXAS localities: Jeff Davis County: Fort Davis, 8-VI-14 (Fall Coll. MCZ); Davis Mts., s. slope, nr. Fort Davis, ca. 5000′, 8-VII-59 Ball family (UASM); Davis Mts., 9-VII, J. W. Green (CAS); same, 20-VIII-14 (Fall Coll., MCZ); same, 6-VII-07, Wenzel (OSUC); "Texas", Wenzel (Probably Davis Mts., OSUC). Presidio County: Marfa, 12-VII-11, J. W. Green (CAS, OSUC, FNMH); Marfa, 4600-4800′, 3-VII-06 Wickham (NMNH); 3 mi. nw. Marfa, 7-IX-51 T. J. Cohn (UASM).

Variation: The mean difference in standardized body length between the Davis Mountains and Marfa samples is slight but statistically significant (Table 1).

Derivation of the specific epithet: named in honor of the orthopterist Theodore J. Cohn, who, over the years, has contributed many fine beetles to my collection, including 1 of the paratypes listed above.

Notes on habitat: I found specimens at about daybreak on the lower slopes of the Davis Mountains in grassland. The soil was clay and sand and was very dry.

Geographical relationships and distribution: The range is not known to overlap the ranges of other *Glanodes* species, and it is at the southeasternmost edge of the area known to be occupied by the members of this subgenus (Fig. 13).

Species inquirendum

Glanodes regressus Casey, 1914: 62. HOLOTYPE female, labelled as follows: "Ari· [dot red]; Casey bequest 1925; TYPE USNM 47737 [red paper].—TYPE LOCALITY.—"near Benson" (from the original description).

This specimen is a female, though Casey declared the type to be a male; but he also wrote that the anterior tarsi were "nude beneath". He stated that the front tarsi of male *Glanodes* were unmodified, and this was the basis for including the group in his tribe Daptini. This specimen probably is a member of *H. obliquus* Horn, but because of its sex a certain identification cannot be made. Furthermore, the type locality is within or near the ranges of 3 species, and so an assignment based on geographical grounds cannot be made.

SPECIMENS NOT IDENTIFIED

Females only were collected in the following localities, and so they could not be identified by association with sympatric males. ARIZONA: Cochise County: 11 mi. e. Sells (TLE); Texas Pass, Dragoon Mts. (CAS); Tucson (NMNH and UCB). NEW MEXICO: Dona Ana County: 17 mi. ne. Las Cruces, Jornada Expt. Sta., 3-X-70 (TTUL); Eddy County: Malaga, 11-VII-36 (UKL).

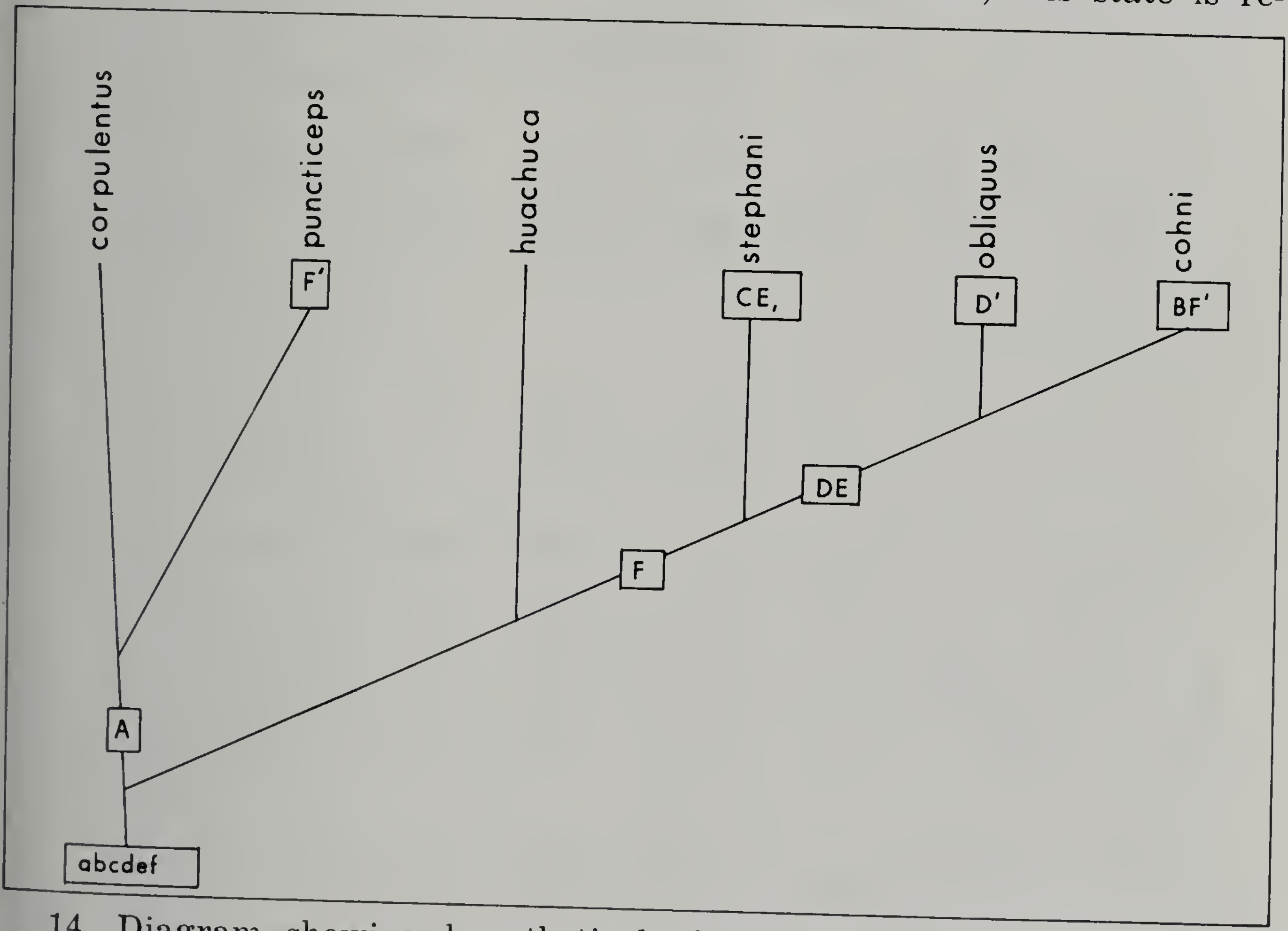
PHYLOGENY OF THE SPECIES OF *Glanodes*

My views on this topic are illustrated in Figure 14. This is a conventional time-divergence diagram, with time on the vertical axis and structural divergence on the horizontal axis. Each character state is designated by a letter: lower case for plesiotypic conditions and capitals for apotypic states (see Ball and Erwin, 1969).

Decisions about phylogenetic classification of character states were based either on frequency of occurrence within the subgenus, or on the development of transformation series or morphoclines. Species with an accumulation of plesiotypic characteristics were regarded as primitive and as representatives of earlier-evolved lineages; those with a majority of apotypic states were judged to be later in origin. Reasons for the assignment to category of each character state are presented below. A summary is presented in Table 5.

Elytral humeri: Because the common state in the Harpali as a whole is untoothed humeri, and because this state is the commonest one in *Glanodes*, it is regarded as plesiotypic.

Elytral microsculpture: The most common state in the Harpali as well as in *Glanodes* is well developed microsculpture. Hence, this state is re-



14. Diagram showing hypothetical phylogeny of the species of subgenus *Glanodes*. See Table 5 for explanation of letters.

garded as plesiotypic. I would also note some evidence of a morphocline in this characteristic. There is a tendency among *H. obliquus* males for marked reduction of microsculpture. This condition is intermediate between the conditions well developed and absent, and locates the *obliquus* line between the *cohni* line and the other *Glanodes* lines.

Median lobe, form: Of the 2 character states observed among *Glanodes* members, the curved condition is more widespread both in the Harpali and in *Glanodes.* Therefore, this state is judged to be plesiotypic.

Median lobe, apex: The broader apex is more widespread both in the Harpali as a whole, and in *Glanodes.* Therefore, it is judged to be the plesiotypic state.

Median lobe, dorso-apical spinules: There are 3 conditions: 1) present, small; 2) present large; 3) absent. The presence of spinules is regarded as plesiotypic relative to "spinuless" because the former is the more widespread in the subgenus. Both large spinules and no spinules are associated with generally more highly derived types of male genitalia, and so those states are regarded as apotypic.

Internal sac, macrospine V: This transformation series is based on the *a priori* assumption that the direction of evolution has been from a short spine to a long one, with intermediate conditions representing intermediate evolutionary stages. Also, the macrospines of *Harpalus* males of other groups tend, on the whole, to be shorter. Thus, the shortest macrospine

TABLE 1: DATA ON VARIATION IN STANDARDIZED BODY LENGTH (MM) AMONG MALES OF THE SUBGENUS GLANODES

SPECIES & LOCALITY	N	RANGE	x±SE	SD	CV%
corpulentus					
Wasatch, Utah	2	8.92 – 9.18	9.05		
Virgin River, Utah	1	9.00			
puncticeps					
Peach Springs, Arizona	2	9.68 – 10.22	9.95		
s. Frazier's Well, Arizona	12	8.75 – 10.25	9.48±0.15	0.49	5.16
nr. Paulden, Arizona	1	7.42			
huachuca					
Huachuca Mts., Arizona	1	8.85			
stephani					
Baboquivari Mts., Arizona	2	9.22 – 10.02	9.62		
Arivaca, Arizona	1	9.65			
Culberson Co., Texas	1	9.00			
obliquus					
Magdalena Mts., N. M.	2	8.65 – 9.10	8.88		
41 mi. sw. Magdalena, N. M.	3	8.78 – 8.88	8.82		
Silver City, N. M.	1	8.00			
Ft. Grant, Arizona	1	8.60			
Stockton Pass, Arizona	1	6.98			
Webb, Arizona	1	8.00			
Chiricahua Mts., Arizona	1	7.72			
Hereford, Arizona	1	8.78			
Huachuca Mts., Arizona	4	7.72 – 8.78	8.40		
cohni					
Davis Mts., Texas	9	8.10 – 8.32	8.81±0.14	0.39	4.46
Marfa, Texas	13	8.65 – 9.70	9.22±0.08	0.29	3.16

V of *Glanodes* males is the closest approach to the average condition of macrospine length in other groups of *Harpalus.*

The most primitive species is *H. huachuca,* its males exhibiting no apotypic character states. The most derivative species is *H. cohni,* whose males exhibit only 1 plesiotypic state. The other species occupy various intermediate positions.

The most discordant element in this scheme is *H. stephani.* The male genitalia do not fit in with those of the other taxa, except that in proportions the specimens of *H. stephani* are intermediate in position (see Graph 1). The only other assumption that one could make concerning the relationships of *H. stephani* is that it represents the sister group of all of the other species of the subgenus.

Another rather discordant element is the elongate macrospine V of *puncticeps* males. This is believed to be a highly derived characteristic, and it seems strange appearing in an otherwise rather primitive stock. The assumption required is that macrospine V became elongate twice.

This hypothetical phylogeny is discussed further, in terms of geographical distribution of the extant taxa.

ZOOGEOGRAPHY OF THE SPECIES OF *Glanodes*

Only very general statements can be made about the possible geographical history of *Glanodes* because: 1) the sister group of the sub-

TABLE 2: DATA ON VARIATION IN THE RATIO PL/EL AMONG MALES OF THE SUBGENUS GLANODES

SPECIES & LOCALITY	N	RANGE	x±SE	SD	CV%
corpulentus					
Wasatch, Utah	2	0.39 – 0.40	0.39		
Virgin River, Utah	1		0.39		
puncticeps					
Peach Springs, Arizona	2	0.40 – 0.42	0.41		
s. Frazier's Well, Arizona	12	0.40 – 0.45	0.42±0.004	0.014	3.34
nr. Paulden, Arizona	1	0.43			
huachuca					
Huachuca Mts., Arizona	1		0.41		
stephani					
Baboquivari Mts., Arizona	2	0.39 – 0.41	0.40		
Arivaca, Arizona	1	0.42			
Culberson Co., Texas	1	0.41			
obliquus					
Magdalena Mts., N. M.	2	0.38 – 0.40	0.39		
41 mi. sw. Magdalena, N. M.	3	0.40 – 0.41	0.40		
Silver City, N. M.	1	0.40			
Ft. Grant, Arizona	1	0.40			
Stockton Pass, Arizona	1	0.42 0.42			
Webb, Arizona	1	0.42			
Chiricahua Mts., Arizona	1				
Hereford, Arizona	1	0.43			
Huachuca Mts., Arizona	4	0.42 – 0.43	0.42		
cohni					
Davis Mts., Texas	9	0.42 – 0.46	0.44±0.005	0.014	3.26
Marfa, Texas	13	0.43 – 0.48	0.45±0.004	0.014	3.04

genus is unknown, so the area of origin is uncertain; 2) little is known about the actual geographical ranges of the extant taxa; 3) even less is known about the ecological requirements of these species. The history of the extant taxa is inferred from the probable history of the plant communities of which they are a part. It is likely that these taxa are confined to arid grasslands, and this is assumed to be true. It seems desirable to use the information available to make a preliminary assessment of the history and evolution of *Glanodes.*

The pattern: The ranges of 3 species overlap in Arizona, and 4 of the 6 known species occur in that state. Beyond southern Arizona, single species are encountered: to the north and west, *H. puncticeps* and *H. corpulentus*; to the northeast, *H. obliquus*; to the southeast, *H. cohni.* Southward, in Mexico, the group is not known to be represented. Probably this is the result of insufficient collecting.

These species are represented in grassland-type habitats, associated with the edges of deserts: *H. corpulentus* with the Great Basin desert; *H. puncticeps, H. huachuca, H. stephani,* and *H. obliquus* with the Sonoran desert; *H. obliquus, H. stephani,* and *H. cohni* with the Chihuahuan desert.

The grassland habitats are more or less discontinuous, occurring in the south along the flanks of mountain ranges at elevations of 3500 to 5000 feet (Lowe, 1964: 40). Farther north, above the Mogollon Rim, near the Grand Canyon in Arizona, isolated patches of grassland are at elevations between 5000 and 7000 feet. In New Mexico, the San Augustin Plains,

TABLE 3: DATA ON VARIATION IN THE RATIO G: MWA/MLAP AMONG MALES OF THE SUBGENUS GLANODES

SPECIES & LOCALITY	N	RANGE	x±SE	SD	CV%
corpulentus					
Wasatch, Utah	2	0.47	0.47		
Virgin River, Utah	1	0.53			
puncticeps					
Peach Springs, Arizona	2	0.42 – 0.47	0.44		
s. Frazier's Well, Arizona	12	0.36 – 0.53	0.44±0.01	0.05	10.78
nr. Paulden, Arizona	1	0.35			
huachuca					
Huachuca Mts., Arizona	1	0.47			
stephani					
Baboquivari Mts., Arizona	2	0.42 – 0.47	0.40		
Arivaca, Arizona	1	0.44			
Culberson Co., Texas	1	0.38			
obliquus					
Magdalena Mts., N. M.	2	0.22 – 0.26	0.24		
41 mi. sw. Magdalena, N. M.	3	0.21 – 0.25	0.23		
Silver City, N. M.	1	0.25			
Ft. Grant, Arizona	1	0.25			
Stockton Pass, Arizona	1	0.21			
Webb, Arizona	1	0.30			
Chiricahua Mts., Arizona	1	0.22			
Hereford, Arizona	1	0.23			
Huachuca Mts., Arizona	4	0.25 – 0.27	0.26		
cohni					
Davis Mts., Texas	9	0.26 – 0.33	0.30±0.01	0.02	6.48
Marfa, Texas	13	0.25 – 0.32	0.30±0.01	0.02	8.51

surrounded by woodland communities, support grassland. North of the Grand Canyon, the non-arboreal plant communities consist mainly of desert shrub and grasses (Hunt, 1956: Fig. 5). These areas are isolated from the more southerly portions of Arizona by the Colorado River valley, especially by the Grand Canyon, and by the barren Painted Desert and adjacent plateaus. In western Texas, grassland occurs along the slopes of the Davis Mountain—Guadalupe Mountains system (Martin and Mehringer, 1965: Fig. 3). The present fragmented distribution of these habi-

TABLE 4: DATA ON VARIATION IN THE RATIO G: ILV/ML AMONG MALES OF THE SUBGENUS GLANODES

SPECIES & LOCALITY	N	RANGE	x±SE	SD	CV%
corpulentus					
Wasatch, Utah	2	0.22	0.22		
Virgin River, Utah	1	0.22			
puncticeps					
Peach Springs, Arizona	2	0.31 – 0.33	0.32		
s. Frazier's Well, Arizona	12	0.32 – 0.36	0.33±0.004	0.014	4.13
nr. Paulden, Arizona	1	0.35			
huachuca					
Huachuca Mts., Arizona	1	0.20			
stephani					
Baboquivari Mts., Arizona	2	0.27 – 0.28	0.275		
Arivaca, Arizona	1	0.25			
Culberson Co., Texas	1	0.25			
obliquus					
Magdalena Mts., N. M.	2	0.29 – 0.31	0.30		
41 mi. sw. Magdalena, N. M.	3	0.25 – 0.31	0.28		
Silver City, N. M.	1	0.31			
Ft. Grant, Arizona	1	0.29			
Stockton Pass, Arizona	1	0.31			
Webb, Arizona	1	0.26			
Chiricahua Mts., Arizona	1	0.21			
Hereford, Arizona	1	0.25			
Huachuca Mts., Arizona	4	0.26 – 0.29	0.27		
cohni					
Davis Mts., Texas	9	0.35 – 0.39	0.37±0.004	0.012	3.32
Marfa, Texas	13	0.34 – 0.39	0.36±0.004	0.014	3.73

TABLE 5: PHYLOGENETIC CLASSIFICATION OF CHARACTER STATES OF *Glanodes* SPECIES.

CHARACTER	STATE			
	Plesiotypic		Apotypic	
Elytral humeri	not toothed	(a)	toothed	(A)
Elytral microsculpture	evident	(b)	not evident	(B)
Median lobe, form	curved	(c)	straight	(C)
Median lobe, apex	broad	(d)	narrow	(D)
			very narrow	(D′)
Median lobe, spinules	present, small	(e)	present, large	(E)
			absent	(E′)
Macrospine V	short	(f)	long	(F)
			longer	(F′)

tats no doubt accounts for the discontinuous ranges of the *Glanodes* taxa. The allopatry of the species suggests rather extended periods of isolation of these grassland areas. The range of *H. corpulentus* is isolated from the ranges of the other species by the canyon of the Colorado River.

During the Pleistocene, the ranges of the species of *Glanodes* must have been somewhat different from what they are today, for most of the southwestern grasslands were invaded by pine-parkland, at least during Wisconsin time (Martin and Mehringer, 1965: 439). Under these conditions, the ranges and dispersal potential of *Glanodes* populations probably were more limited than they are today. At other times, dispersal potential was probably enhanced by conditions favorable to expansion of grassland areas.

Present range discontinuity implies past continuity, and the explanation for this is likely to be in terms of past climatic events. Also to be accounted for is the relatively high concentration of *Glanodes* species in southern Arizona.

Finally, to be accounted for is a general relationship between the phylogenetic pattern and the distribution pattern of the species. The more primitive species are in the west and north; the more derivative ones are in the south and east.

Historical zoogeography: The present pattern is explained as follows. The ancestral stock of the extant species of *Glanodes* originated in the semiarid areas of the Colorado Plateau, probably north of the Grand Canyon, after the major deserts had developed (i.e. mid-Pliocene time; see Axelrod, 1948). Thus this stock was hemmed in by the Great Basin deserts to the west, by forests to the north, and by mountains to the east. Dispersal southward across the plateau was possible, if the Grand Canyon had not yet developed, and this seems likely (Hunt, 1956: Fig. 61). This early stock eventually spread to southern Arizona, survived in the grassland areas there and in the north, but died out in the country adjacent to the Mogollon Rim. This provided 2 isolated groups of *Glanodes*: a northwestern one and a southwestern one. The northwestern stock diverged in relation to the southwestern one, and later, differentiated to produce different species on opposite sides of the Grand Canyon. Implied here is that the route southward was interrupted before the Grand Canyon was deep enough to form a virtually impassable barrier to dispersal of flightless insects.

In the south, the range of the original invading stock became fragmented; differentiation took place, to produce *H. huachuca* and the ancestor of the *H. stephani-obliquus-cohni* lineage. During a climatically favorable interval, the latter stock became more widespread, ultimately giving rise to *H. stephani* in Arizona, *H. obliquus* in New Mexico, and *H. cohni* in Texas. This likely involved one or more cycles of range contraction-isolation-differentiation followed by dispersal. During a relatively recent favorable period, *H. obliquus* dispersed westward to enter Arizona and *H. stephani* moved eastward into New Mexico and Texas. Finally the ranges of *H. stephani* and *H. obliquus* became interrupted by recurrence of unfavorable conditions.

Most of these alternating episodes of dispersal and isolation-differentiation must be related to events of Pleistocene time, even though it seems that this span is not sufficiently great to permit this amount of speciation. For example, evidence derived from more northern fossil carabids does not suggest that differentiation has taken place during the Pleistocene (Coope, 1970: 106). Further, Hopkins, *et al* (1971) show that differentiation of some carabids likely took place between late Pliocene and the present. I suggest that if these *Glanodes* taxa were older one might reasonably expect wider geographical ranges, more instances of sympatry, and additional species in other, more remote geographical areas. I believe, therefore, that the rate of differentiation of this group was more rapid than average.

It is known that grassland areas were invaded by woodlands during the Wisconsin glacial stage. In the more xeric post-glacial times, the woodland withdrew to more mesic situations, and desert and grassland were able to expand. Fire may have been a factor in the restriction of woodland (Humphrey, 1956; Wells, 1970). Of course, as areas become more xeric, grasslands are replaced by deserts. Possibly then, the desert grasslands were at their maxima for brief periods following termination of pluvial intervals, and during such periods, dispersal of *Glanodes* may have taken place. Conversely, fragmentation of the grasslands probably occurred both during dry and wet periods.

The above interpretation accounts for the general phyletic pattern of *Glanodes*, but it does not explain why there are more species in southern Arizona than elsewhere. I think this is the result of the presence of desert mountains in southern Arizona, the bases of which probably provided favorable sites for isolated grassland refugia during periods of excessive drought. These refugia would have permitted the initial differentiation of the *Glanodes* lineage in the south and the survival of the early descendants, *H. huachuca* and *H. stephani*. These stocks were joined later by *H. obliquus* populations.

This highly speculative account of the dispersal and evolution of *Glanodes* may be substantially modified when more is known about relationships of the subgenus and about the distribution and ecological requirements of the extant species. This small group would seem ideal for a detailed study of comparative ecology and speciation, and the additional information obtained would provide the evidence for evaluating the hypotheses presented above. Such work could best be done by a person living in southwestern United States.

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Book Review

The compleat naturalist; a life of Linnaeus by Wilfrid Blunt. 1971. The Viking Press, Inc., 625 Madison Ave., N.Y., N.Y. 10022. 256 p.; numerous illustrations; $14.95, cloth. (With an appendix on Linnaean classification, nomenclature, and method by William T. Stern, p. 242-252).

No botanist or zoologist can ever be quite as famous and universally known as Linnaeus (or often just L.—even John F. Kennedy needs 3 letters [JFK]) for recognition. Only Fabricius (lesser known because of his narrower specialization) is easily recognized, at least by Coleopterists, by one initial (F.). Linneaus not only founded our present binomial system of nomenclature (1758), but he described approximately 4,400 species of animals and 7,700 species of plants.

The Linnaean Society of London has had most of Linnaeus' insect collections since 1829, but some are also deposited at the Zoological Institute in Uppsala, Sweden. Although several books, and many articles, have dealt with the life of Linnaeus, none is more beautifully executed than this new one. Although the emphasis is on his botanical activities, much of the text relates to the man and his ideas. It would be profitable reading for every biologist—but a must for every serious student of Coleoptera.—R. E. Woodruff.
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BOOK REVIEW

by David H. Kistner
Shinner Institute for the Study of Interrelated Insects,
Dept. of Biology, California State University,
Chico, Calif. 95926

The Insect Societies by Edward O. Wilson. 1971. xii + 548p., $20.00. Belknap Press of Harvard University Press, 79 Garden St., Cambridge, Mass. 02138.

It is difficult to find new superlatives for a book which has received such excellent reviews, (i.e. Eberhard 1972, Richards 1971). I think it is one of the best books written in recent years in all of biology; certainly the best that has been written on social insects. One can admire and use a book even if one does not agree with every position taken by its author.

After 2 introductory chapters in which Wilson defines social behavior and states his theme of expressing insect sociology as population biology, he then presents 5 chapters to introduce some of the varieties of habits of the social wasps, the ants, the social bees, the termites, and finally the presocial insects. These introductions to the various groups of social insects are not exhaustive; rather carefully selected examples are given to illustrate major adaptive trends. Almost any of these chapters could be expanded into a book of its own.

Coleopterists will be especially interested in the chapter on presocial insects because of the good review of subsocial behavior in the beetle families, Staphylinidae, Silphidae, Hydrophilidae, Scarabaeidae, Passalidae, Tenebrionidae, Chrysomelidae, Scolytidae, and Platypodidae.

The 3 chapters on caste determination provide very good summaries of what is known about the subject in the principle groups of social insects. Furthermore, Wilson points out many of the areas where our knowledge is weak. These chapters should provide a gold mine of significant problems for future researchers.

The general area of communication is divided into 3 chapters entitled: (1) alarm and assembly, (2) recruitment, and (3) recognition, food exchange, and grooming. Under alarm and assembly, the exciting and fast moving field of social pheromones is reviewed. Tactile and auditory alarm signals are given their due also, even though Wilson believes these to be of far less significance than chemical signals. Recruitment communication is also largely olfactory, ranging from the odor of food taken back to the nests to the well known odor trails laid by ants, bees, and termites. The bee dances, which also function to recruit workers to food, are thoroughly reviewed from the points of view of their evolutionary origin, information content, and racial and species differences. Discussions of olfactory and tactile responses involved in colony recognition, caste recognition, recognition and transport of the dead, cannibalism and trophic eggs, and trophallaxis, as well as grooming and chain transport are lucidly done in the final chapter on communication. The grouping of these diverse phenomena under communication is in line with Wilson's idea which he states on p. 234, "The remarkable qualities of social life are mass phenomena that emerge from the integration of much simpler individual patterns by means of communication. If communication itself is first treated as a discrete phenomenon, the entire subject becomes much more readily analyzed."

Dominance hierarchies and their function in queen selection in wasps and the control of nestmates by the queen through the use of pheromones is treated in a chapter called, "Group effects and the control of nestmates." Social homeostasis is reviewed using thermo-regulation by bees, ants, and termites as examples as well as moisture regulation by ants and termites. Contrary to Wilson, I think the supraorganism concept will be used again when reductionist techniques have revealed all the integrating mechanisms that control the social responses in the various types of social insect colonies. Right now when we are all focused on narrowly defined problems, the concept is superfluous. If and when we start putting the pieces together, we will once again need analogies to guide us even if they are "semiconscious".

Three of the most useful chapters are: 17, The Genetic Theory of Social Behavior; 18, Compromise and Optimization in Social Evolution; and 21, The Population Dynamics of Colonies. The genetic theory of social behavior as developed by W. D. Hamilton is an attempt to explain the evolution of social organization by the greater altruism that would be exhibited by sisters with a haploid father because they would share more genes (3/4) than those sisters with a diploid father (1/2). While this is speculative as Wilson admits, he marshalls the available evidence in its support and suggests areas where additional information is needed. Even if the theory is found to be true for the social Hymenoptera, its significance to other social groups may be more important if it can be shown that brother-sister matings occur more frequently in the higher termites than in free-living groups or even in the lower termites.

In "Compromise and Optimization in Social Evolution," Wilson reviews the areas of the evolution of monogyny (single queens per colony), and division of labor (called ergonomics). In this chapter, he again tries to apply optimization theory to the caste system in social insects. Many additional observations and experiments are needed to verify these theories.

The chapter on population dynamics of colonies summarizes the rapidly accumulating data on longevity and survivorship, colony growth and senescence, competition and territoriality, control of colony density and species diversity, and colonial dispersal. Among diverse phenomena documented, it is interesting to read that the most elaborate social behavior has evolved in those colonies with large numbers and which survive more than 1 year.

The chapter on symbioses among social insects reviews the fascinating subject of social parasitism in ants, wasps, bees, and termites. Wilson views the ultimate stage of social parasitism as worker-less reproductives which infest nests of other species and produce eggs which yield only new males and females. He also presents a new interpretation of the evolution of dulotic (slave making) ants which are usually closely related to their ant hosts. This explanation appears to hold for the social parasites of wasps and bees also where the social parasites are most closely related to their hosts.

Coleopterists will be especially interested in the chapter entitled, "Symbioses with Other Arthropods." After reviewing the general terminology of the field, he presents very useful charts giving the major groups of ectosymbionts of social insects with some of the pertinent references. He lists 37 families of Coleoptera which have been found in nests of social insects. He then reviews aspects of ectosymbiotic adaptations which include lighter body coloration, novel glands which produce appeasement substances among other things, and mimicry. He gives a fair review of mimicry but I find his explanation that mimicry is directed at predators outside the driver ant colony just as unconvincing as he finds the "Wasmann-Kistner" explanation (i.e. that the mimicry is directed at the ants and is used as an integrating mechanism). Strange ants are not destroyed by African driver ants whether they are from the same colony, other colonies of the same species, or even colonies of different species. Odor does play a role, but not a crucial one, in the driver ant's acceptance of a strange ant. If a worker ant is introduced into a raiding column from another species of driver ant colony, this creates a severe disturbance with worker ants spreading out in a circle around the point of introduction. The introduced ant reacts to this excitement by spreading its legs widely and remaining motionless with its body close to the ground. In our field work, we referred to this as "hugging the ground." After 10-15 minutes, the excitement subsides with the workers that formerly spread out returning to the columns and going about their normal raiding behavior. After this occurs, the introduced ant joins the colony in the raiding process unharmed. If the ant is of another species (*Crematogaster*), it creates still more excitement (i.e. the circle of ants running about the point of introduction is larger). It will also remain motionless until the activity returns to normal whereupon it will remove itself from the column, again unharmed. This sort of non-aggression toward ants permits side by side raiding of *Dorylus* (*Anomma*) *nigricans* ssp. *burmeisteri* var. *molestus* (Gerst.) Mayr and *D.* (*D.*) *helvolus* Linn. It also permits easy raiding on *D.* (*A.*) *nigricans* ssp. *arcens* by *D.* (*Typhlopone*) *fulvus* ssp. *badius* var. *obscurior* Santschi—a species which is specially adapted for these kinds of raids. This may also be the reason why so many independent invasions of their colonies have occurred by so many insect species.

The Wasmann-Wilson explanation that the physogastry of the Termitoxeniinae represents a means to project fatty tissue could be true of the Termitoxeniinae which lack hypodermal glands (Malin and Kistner 1971) without being true of staphylinids where large numbers of glands have been found whenever they have been sought.

Limuloid body shape was very curiously examined. Limuloid species of myrmecophiles are at least as plentiful in the colonies of African driver ants as mimics. One wonders how predators would react to large lumbering forms in the columns, such as *Mimocete* sp., if they have exerted enough influence to cause the evolution of mimicry by other inhabitants of the same nests. In any event, no one has demonstrated yet that there are predators sitting by the side of the columns which are eating anything other than ants. The birds which are associated with Neotropical and Ethiopian army ants eat insects which are displaced by the ants, or the ants themselves, not the myrmecophiles in the columns, (Bequaert 1922:314).

The review of integrative behavior is one of the best I have ever read. Ectosymbionts have been shown to follow the chemical trails of ants, they can produce appeasement substances, can beg for food which is provided by regurgitation, can perhaps acquire their hosts odors by active grooming and/or by the production of similar or identical pheromones.

In a scant 36 pages it is hard to do justice to the tremendous array of myrmecophiles and termitophiles but Wilson even manages to include the trophobionts (Homoptera and certain Lycaenid butterflies) and speculations of why wasps and bees have fewer guests. On the whole it is a fair and creditable review; but like the ants, termites, bees, and wasps, a whole book should be devoted to it in the future.

The last chapter of the book is devoted to a brief prospectus for a unified sociobiology which accepts the validity of comparing vertebrate and insect societies if only to "increase our understanding of the unique qualities of social behavior in animals as opposed to those of man."

The technical aspects of the volume are superb. The writing is always lucid. All photographs and text drawings are superbly reproduced and no illustration was reduced to the all too frequent vanishing point merely to save space. I have looked for typographical errors and only found 1 in 548 pages (oxybeline on p. 125 should be oxyteline). Someone told me Belknap Press is a subsidized press. If so, I hope we have more of them in the future if only to preserve such fine craftsmanship.

The book is an important new textbook for courses on Social Insects. It should be read by all biologists and should provide inspirational reading to all future students of social insects who will respond to many of Wilson's positions much the way we did to those of Wheeler (1928) in his predecessor book—by further investigation.

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Book Review

Biological Control Edited by C. B. Huffaker. 1971. Plenum Press, New York and London (227 W. 17th St., N. Y. 10011). 511p.; illus. $19.50, cloth.

This book, comprised of papers presented as a symposium of the combined Ecological Society of America and the American Association for the Advancement of Science in December 1969, contains 20 chapters contributed by 30 specialists. These are prominent workers in the field of biological control and pest management in Europe, Asia, Africa, and North America. As stated by the editor in the preface, "The emphasis is on documented cases of biological control and the use of biological control in developing integrated control programmes around the world."

The book is divided into 4 sections. In addition to pointing out the disastrous consequences that have arisen from the *indiscriminate* widespread use of chemical pesticides and discussing 2 problems compounded by this factor (i.e. cotton insects in Peru and the grape leafhopper in California which have been solved by methods of integrated control), Section I deals with the theory of ecological and technical means of assessing biological control agents. Section II presents several recent outstanding examples of classical biological control. Of particular interest to coleopterists is the "success story" of the chrysomelid, *Agasicles hygrophila,* the first insect successfully introduced for the control of an aquatic weed, and which has given satisfactory control of alligator weed in parts of the southeastern United States. Similarly the curculionids, *Microlarinus lareynii* and *M. lypriformis,* have given useful control of puncture vine in Hawaii and to a lesser extent in California. The cerambycid, *Plagiohammus spinnipennis,* and the hispids, *Octotoma scabripennis* and *Uroplata girardi,* are other beetles which figure prominently in programmes dealing with the biological control of weeds. In papers on biocontrol of insect pests, the classical case of *Rodolia cardinalis* and its successful control of cottony cushion scale is reviewed once more, and mention is made of another coccinellid, *Cycloneda sanguinea,* used to control aphids on glasshouse crops. The general role of coccinellids as agents of natural control receives mention in Section III, "The Unheralded Naturally Occurring Biological Control." Section IV, "Biological Control as a Key Element in the Systems Approach to Pest Control", deals with several instances of successful or developing programmes of integrated control. It points to the conclusions (which have generally gained wide acceptance in recent years) that, while we can't at present do without chemical pesticides, their use should be considered as a last resort rather than being first choice. In its finest sense integrated control should take into account all natural factors, attempt to manipulate or augment them, and, where necessary, superimpose a properly supervised programme of pesticides.

The number of symposia on biological control, integrated control, and related topics is likely to increase over the years. Let us hope that the high standard of contributions achieved in the one under review is maintained.—F. D. Bennett (Commonwealth Institute of Biological Control, Curupe, Trinidad).

(*continued from inside front cover*)

or counties listed. Dates are listed by day, month (in Roman numerals), and last 2 digits of the year. Listing of ecological data is encouraged. Location of specimens should be shown in brackets; if the data is extensive these should be abbreviated as shown and the abbreviations listed in the text.

Any article concerning Coleoptera will be considered.. Descriptions of new taxa must contain keys (or be correlated with existing keys) and illustrations. All manuscripts should be typed on 8½x11" opaque white paper with 1 inch margins. They should be typed on one side only and double spaced throughout (including title, footnotes, tables, figure legends, and references). All scientific names should be underlined. Use the following order: title, author, author's address, abstract, body of text, references cited, and figures. All footnotes, tables, and figure legends should be provided on separate sheets and double spaced. Indicate approximate figure and table locations in pencil in the margin of the manuscript.

An abstract should be a concise statement of the facts presented, not *that* they are presented (e.g. list names of organisms, not just that they were discussed or described as new). These abstracts are the key to how your article will be cited in the abstracting journals and should be carefully written.

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NOTICES

Notices to appear on this page are a free service to members and subscribers. Such copy will be limited to the back page, the older notices being moved up and replaced with the newest ones at the bottom. The editor reserves the right to reword such notices for brevity, consistency, and clarity.

SCARABAEIDAE: Studying myrmecophilous and termitophilous Aphodiinae. Request loan of New World material especially. Will sort from general scarab collections or from light trap samples. Robert E. Woodruff, Fla. Dept. Agr., P. O. Box 1269, Gainesville, FL 32601.

HYDROPHILIDAE: Presently revising the genus **Hydrochus** from North, South, and Central America, including the Antilles. Request loan of any material from the Western Hemisphere. John L. Hellman, Ent. Dept., Univ. Maryland, College Park, MD 20742.

TENEBRIONIDAE: Building world-wide reference collection. Will purchase or exchange other Coleoptera. Especially desire immature stages. Kirby W. Brown, Peabody Museum, Yale Univ., New Haven, CT 06520.

HELODIDAE: Revising **Elodes**, need material from NW, W, SW, & S. Will pay postage. Prefer wet material, but mounted or dry OK. Desire larvae also. G. G. Kennen, 381 N. Central Ave., Ramsey, N.J. 07446.

CLEROIDEA: Conducting world-wide research on internal anatomy. Will exchange North and Central American groups for liquid (10% Formalin, etc.) preserved Cleroidea. Building world reference collection of Cleridae; will purchase or exchange. Ginter Ekis, Dept. Ent. & Econ. Zool., Rutgers, Univ., New Brunswick, N.J. 08903.

SCARABAEIDAE: Wanted, various species of **Megasoma**, male and female, major and minor forms. Will exchange pairs of **M. pachecoi.** Terry W. Taylor, 8529 Norwood Place, Rosemead, CA 91770.

CICINDELIDAE: Interested in obtaining specimens of **Cicindela hirticollis ponderosa** Thoms. from area of Veracruz, Mexico. Will exchange other Coleoptera. R. C. Graves, 627 Crestview, Bowling Green, Ohio 43402.

FOR SALE: Malaysian and Indonesian Coleoptera and Lepidoptera (over 900 species), including horned rhinoceros, stag, and long-horned beetles; send for list and prices. Sim Yam Seng, 21 Joon Hiang Rd., Singapore (19), Malaya.

DYTISCIDAE (Bidessines): Revising genera **Anodocheilus** and **Neobidessus** for tropical America. Will sort from general collections or light trap material, but promise only generic determinations of other Dytiscidae. F. N. Young, Dept. Zoology, Indiana University, Bloomington, Ind. 47401.

SCARABAEIDAE: Working toward a world revision of the Anomalini. Specimens and records needed from all areas, by loan, purchase, or general exchange. Identifications by arrangement, correspondence invited. R. W. L. Potts, California Acad. Sci., Golden Gate Park, San Francisco, CA 94118.

COCCINELLIDAE: North American specimens and locality records of **Coccinella undecimpunctata** L. required for distribution study of this species. M. Y. Watson, Dept. Biology, Laurentian Univ., Sudbury, Ontario, Canada.

REPRINTS DESIRED: Now working on the interpretation and integration of available evidences on phylogeny in construction of a phylogenetic classification of Coleoptera. Reprints are requested from specialists in all families. Mohammad Abdullah, Zoologische Staatsammlung, 8 Munich 19, W. Germany.

CARABIDAE: Need material for study of New World **Philochtus** (Bembidiini) including **Cyclolopha.** G. G. Perrault. 138 Rue Houdan, 92, Sceaux, France.

LUCANIDAE: Buy, sell, exchange all species. Also wanted: collection data and World literature on the family. Chris Adamson, 2030 Bancroft Way No. No. 5, Berkeley, CA 94704.

PYROCHROIDAE: Building world-wide reference collection. Will purchase or exchange for other Coleoptera. Desire all life stages, rearing data, observations, etc.; correspondence invited. Daniel K. Young, Dept. Ent., Michigan State University, East Lansing, MI 48823.

HYDRAENIDAE (Limnebiidae): Revising genera **Hydraena** and **Limnebius** for Western Hemisphere. Request loan of adults and/or larvae. Philip D. Perkins, Dept. Entomology (Coleoptera), National Musuem of Natural History, Smithsonian Institution, Washington, D.C. 20560.

WANTED: One copy of **Biologia Centrali-Americana,** Coleoptera, Vol. 11 part 2. T. W. Taylor, 8529 Norwood Place, Rosemead, California 91770.

CARABIDAE: Dr. Gianluigi Alzona, c.so G. Ferraris 108, 10129-TORINO (Italy) would like to exchange **Carabus, Calosoma, Cychrus** in U.S.A., Canada, India, Middle East, U.S.S.R., China.

HYDROPHILIDAE: Presently revising the genus **Anacaena** of the world. Request loan of any available material. Jarrett L. Cross, Entomology Department, Smithsonian Institution, Washington, D.C. 20560.

WORLD RESEARCH DIRECTORY: Richard L. Jacques, Jr. and Ross H. Arnett, Jr. are preparing a world list of current research projects on Coleoptera. A volume will be published as a companion to the recently published "Directory of Coleoptera Collections." Anyone wishing to have a research project listed should write to R. L. Jacques, Jr., Dept. of Biology, Fairleigh Dickinson University, Rutherford, N.J. 07070.

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THE COLEOPTERISTS BULLETIN

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THE COLEOPTERISTS BULLETIN

(FOUNDED 1947 BY ROSS H. ARNETT, JR.)

The **Coleopterists Bulletin** is published quarterly, beginning in March, by the Coleopterists Society. All manuscripts, editorial questions, or business matters should be sent to the editor: Dr. Robert E. Woodruff, Florida Department of Agriculture, P.O. Box 1269, Gainesville, Florida 32601.

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Manuscripts will be considered from any authors, although those from members of the Coleopterists Society will be given priority. It is suggested that all prospective authors join the Society. All manuscripts should conform to instructions in the **Style Manual for Biological Journals** (3rd Ed.) prepared by the Committee on Form and Style of the Conference of Biological Editors, and published by the American Institute of Biological Sciences, 2000 P Street NW, Washington, DC 20063.

The following exceptions are noted: 1) All geographical names are to be spelled out, 2) use words, not symbols, for male and female, 3) use numerals throughout, except to begin a sentence, 4) entomology, -ical, -ist, etc. are to be abbreviated Ent. in literature citations.

Specimen label data should be listed in the following manner: MEXICO: State of Veracruz, Fortin de las Flores, 10-VIII-70, I. B. Jones, under bark of **Pinus moctezumae**, 7000ft. [USNM] (2). The number in parentheses indicates the number of specimens. Geographical names are listed in order with largest units first, with states, departments, provinces, parishes, and/

Continued inside back cover

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THE COLEOPTERISTS BULLETIN 27(1), 1973

NEW GENERA AND SPECIES OF BOLIVIAN ELMIDAE (COLEOPTERA)

H. E. HINTON

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Woodland Rd., Bristol, BS8 1UG, England

ABSTRACT

A new genus *Holcelmis* with 2 new species, *H. woodruffi* and *H. mamore*, and a related new genus and species, *Epodelmis rosa*, are described from the lowlands of Bolivia.

INTRODUCTION

Both *Holcelmis* and *Epodelmis* are related to the genus *Hexacylloepus* Hinton, which they seem largely to replace in the lowlands of Bolivia and perhaps also of Peru and adjacent areas. All known specimens of *Holcelmis* and *Epodelmis* were taken at light. The plastron-bearing groups of the family Elmidae normally live in fast-flowing streams, and their claws are large and strong. Such streams are absent over much of the area occupied by *Holcelmis*, and the species of this genus may prove to be rather exceptional in living in slow-moving or even standing water. In this connection it is of interest to note that the claws of *Holcelmis* are more delicate than those of any other plastron-bearing elmid known to me.

The holotypes of *H. woodruffi* and *E. rosa* will be deposited in the Florida State Collection of Arthropods, Gainesville, Florida. The holotype of *H. mamore* remains in my collection.

Holcelmis Hinton, NEW GENUS

Body subparallel. Antennae (Fig. 2) 11-segmented. Maxillary palpi (Fig. 3) 4-segmented. Pronotum with a well-developed sublateral carina on each side on basal four-fifths; disk with a broad, median longitudinal depression and with a broad, more or less distinct, depression on each side on basal half; lateral margin of pronotum when seen from side not double; sides, especially near apical angles, broadly dilated (Fig. 1, A) and with area near lateral margin flexed upwards. Elytron with 2 well-developed, granulate, sublateral carinae, 1 on 6th interval and 1 on 8th interval; apices of elytra not produced. Prosternum long in front of anterior coxae; process between coxae short and narrow (Fig. 1, D); prosternum without distinct sublateral carinae. Abdomen without sublateral carinae on disk of first sternite (Fig. 1, D). Legs with a single cleaning fringe on front and hind tibiae and 2 cleaning fringes on middle tibiae; claws slender, not toothed. Plastron of narrow or broad scale-like hairs with serrated sides (Fig. 1, E) present on the following areas: head below and behind eyes; hypomera (Fig. 1, B); epipleura; sides of pro-, meso-, and metasternum; all of abdomen except disk of first sternite; trochanters, femora, and tibiae.

GENOTYPE: *Holcelmis woodruffi* Hinton, new species.

COMPARATIVE NOTES: The species of *Holcelmis* have a close superficial resemblance to those of *Hexacylloepus* Hinton, and the distribution of the plastron on the hypomera (Fig. 1, B), prosternum, and elsewhere is the same or very similar in the 2 genera. *Holcelmis* may be distinguished by the strongly dilated sides of the pronotum (Fig. 1, A) and the texture of the pronotum and elytra, which is rather "leathery" instead of hard and rigid. *Holcelmis* lacks sublateral carinae on the prosternum and on the disk of the first abdominal sternite, whereas prosternal and abdominal sublateral carinae are nearly always distinct in *Hexacylloepus*.

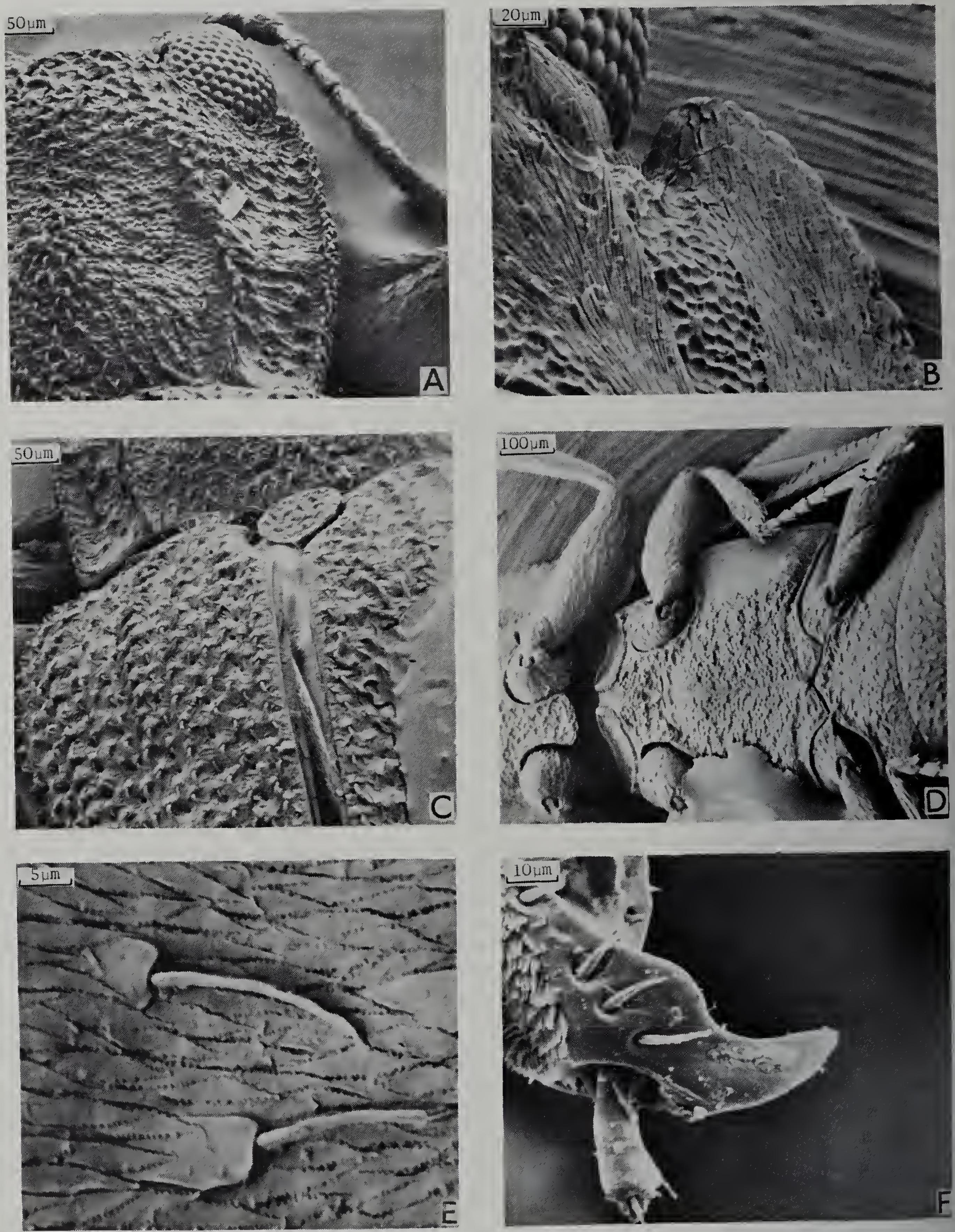


Fig. 1: Scanning electron micrographs of *Holcelmis woodruffi*, sp. n. (A) dorsal view of right side of pronotum; (B) anterior part of hypomeron and side of prosternum; (C) base of elytra and pronotum; (D) ventral surface; (E) plastron of third abdominal sternite; (F) coxite and movable stylus of female genitalia.

The 2 species of *Holcelmis* may be distinguished as follows:

1. Pronotum across broadest point much broader than long (0.60 mm: 0.48 mm). Pronotum with median longitudinal depression scarcely evident on basal fourth of disk; sides of median depression broadly raised, almost subcarinate at basal third; sublateral depression as distinct and deep as median depression; disk with a shallow but distinct transverse depression on middle .... *Holcelmis woodruffi*, sp. n.

1′. Pronotum across broadest point only a little broader than long (0.55 mm: 0.50 mm). Pronotum with median longitudinal depression shallow but distinct almost to base; sides of median depression not distinctly and broadly raised; sublateral depression much less distinct than median depression; disk without a distinct transverse depression across middle .... *Holcelmis mamore*, sp. n.

Holcelmis woodruffi Hinton, New Species

(Fig. 1-5)

Male. Length, 1.7-1.8 mm; breadth, 0.7 mm. Cuticle moderately pale reddish brown; head darker, eyes black; antennae and tarsi paler and more yellowish. *Pronotum* across broadest point, which is at about basal two-fifths, broader than long (0.60 mm: 0.48 mm) and base broader than apex (0.50 mm: 0.45 mm). Side arcuate, almost straight before basal angle; near lateral margin bent upwards. Sublateral carina broad, prominent, with inner edge sharp, and extending to about apical fourth; carinae distinctly converging beyond middle. Median longitudinal depression broad and deep on middle half of disk but absent or very indistinct on apical and basal fourth; at basal third with sides broadly raised, almost subcarinate. Disk with a shallow but distinct transverse depression at middle. Sublateral depression about as long and deep as discal depression. Surface of disk with round granules about as coarse as facets of eyes; surface between granules with a reticulate microsculpture; granules on elevated parts of disk usually separated by 1 to 2 diameters but sparser or absent on bottom of median and sublateral depressions. *Hypomera* with plastron absent on posterior third; belt on anterior part (Fig. 1, B) extending on a broad front to lateral (dorsal) margin and forwards to apex; anterior plastron-free belt distinctly narrower than front femur. *Elytra* slightly more than twice as long as pronotum (1.18 mm: 0.48 mm). Fourth discal interval subcarinate on basal region. Surface of discal intervals with granules as large but not as elevated as those of pronotum and usually separated by 2 to 3 diameters; surface between granules more or less smooth, without a distinct reticulate microsculpture like pronotum. Discal strial punctures deep, round to subquadrate, not as broad as intervals, and separated longitudinally by 1 to 2 diameters. Epipleura with plastron absent beyond a point about opposite middle of second abdominal sternite. Scutellum obovate, flat, and with surface granulate like adjacent parts of elytra. *Prosternum* with a moderately narrow belt of plastron extending to sides of disk. *Metasternum* with disk nearly flat. Median longitudinal line narrow, shallow, and nearly complete. Surface of disk with flat-topped granules slightly coarser than facets of eyes and usually separated by 1 to 2 diameters; surface between granules with a conspicuous reticulate microsculpture. *Abdomen* with disk of first sternite not distinctly depressed. Plastron present everywhere except on disk of first sternite. *Legs* with plastron on trochanters and plastron complete on femora and tibiae.

Female. Externally similar to male.

Holotype male: BOLIVIA: Dept. Santa Cruz, Prov. Sara, Santa Rosa, at light, 21-II-1969, A. Martinez & R. E. Woodruff.

Paratypes. 45, with same data as holotype.

I take pleasure in naming this species after Dr. R. E. Woodruff.

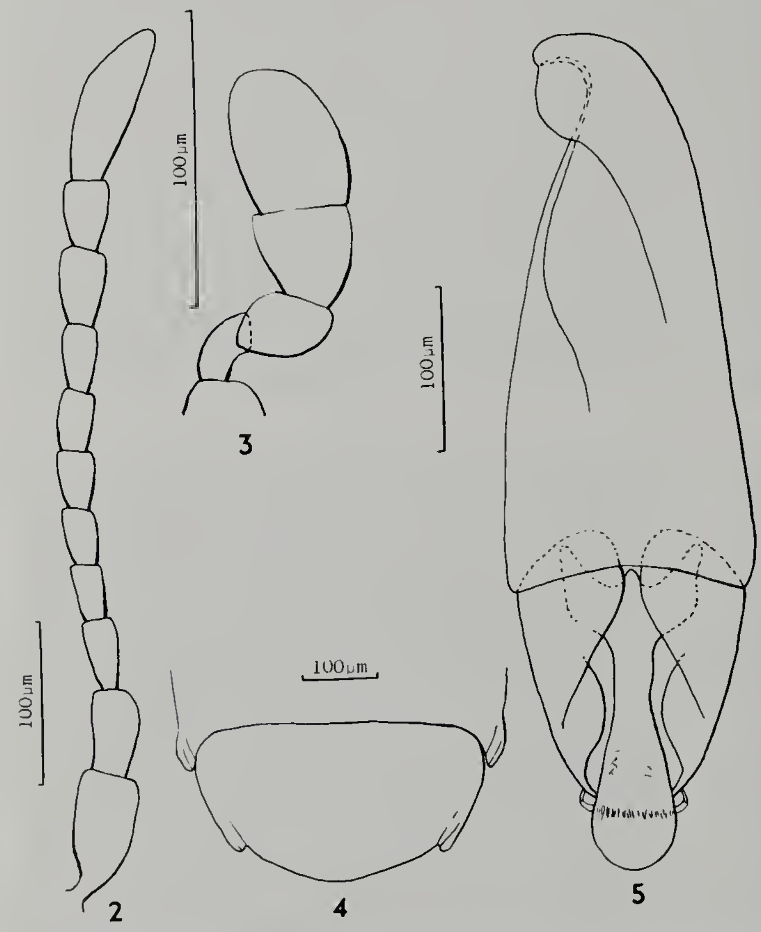
Holcelmis mamore Hinton, New Species

Female. Length, 1.8 mm; breadth, 0.7 mm. Externally similar to *H. woodruffi* but (1) with pronotum distinctly narrower: across broadest point, which is at about basal two-fifths, only a little broader than long (0.55 mm: 0.50 mm) and base broader than apex (0.45 mm: 0.40 mm); (2) median longitudinal depression of pronotum distinct almost to base; (3) sides of median depression not broadly raised and almost subcarinate; (4) sublateral depression of pronotum less distinct than median depression; and (5) disk without a distinct transverse depression across middle instead of with a very distinct transverse depression.

Male. Unknown.

Holotype female: BOLIVIA: Rio Mamoré, near Guyara-Mirim, at light, 20-VIII-1937, H. E. Hinton.

In addition to the differences listed above, *H. mamore* also differs from *H. woodruffi* in having the suberect setae of the elytra slightly shorter and finer. However, this difference between the 2 species is not great enough to appreciate without direct comparison.



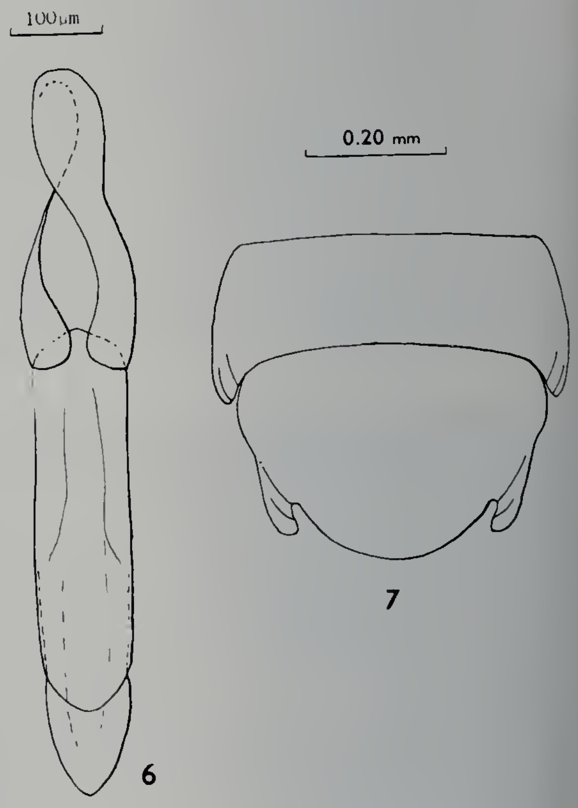


Fig. 2-5: *Holcelmis woodruffi*, sp. n.: (2) antenna; (3) maxillary palpus; (4) ventral view of fifth externally visible abdominal sternite; (5) dorsal view of male genitalia.

Fig. 6-7: *Epodelmis rosa*, sp. n.:(6) dorsal view of male genitalia; (7) ventral view of fourth and fifth externally visible abdominal sternites.

Epodelmis Hinton, New Genus

Body subparallel. Antennae 11-segmented. Maxillary palpi 4-segmented. Pronotum with a well-developed sublateral carina on each side on basal three-fifths; disk with a shallow, median longitudinal depression that is only distinct on about middle fourth; with a shallow but distinct sublateral depression on each side adjacent to inner edge of sublateral carina on about basal two-fifths; lateral margin when seen from side not double; sides, especially near apical angles distinctly dilated and flexed upwards. Elytron with 2 well-developed, granulate, sublateral carinae, 1 on 6th interval and 1 on 8th interval; apices of elytra moderately strongly produced and conjointly more or less truncate. Prosternum long in front of front coxae; process short and distinctly narrower than a front coxa; prosternum without sublateral carinae. Abdomen without sublateral carinae on disk of first sternite. Legs with a single cleaning fringe on front and hind tibiae and 2 cleaning fringes on middle tibiae; claws short, slender, not toothed. Plastron present on the following areas: head below and behind eyes; hypomera as in *Hexacylloepus* and *Holcelmis* except that a broad belt extends adjacent to lateral (dorsal) margin to posterior margin; epipleura; sides of pro-, meso-, and metasternum; all of abdomen except disk of first sternite; and trochanters, femora, and tibiae.

GENOTYPE: *Epodelmis rosa* Hinton, new species.

COMPARATIVE NOTES: *Epodelmis* bears a close superficial resemblance to *Holcelmis* but may be distinguished by (1) the produced apices of the elytra; (2) the extension of the plastron on a broad front to the posterior margin of the hypomera; and (3) the very different structure of the male genitalia (*cf.* Fig. 5 & 6). *Epodelmis* resembles some of the species of *Hexacylloepus*, but in the latter genus a plastron is always absent on the posterior third of the hypomera, and, although the male genitalia vary greatly in structure, they never approach that of *Epodelmis*.

Epodelmis rosa Hinton, New Species

(Fig. 6-7)

Male. Length, 2.2 mm; breadth, 0.8 mm. Cuticle moderately pale reddish brown with head darker, eyes black, and antennae and tarsi more yellowish than body. *Pronotum* across broadest point, which is at about basal two-fifths, broader than long (0.66 mm: 0.55 mm) and base broader than apex (0.65 mm: 0.45 mm). Side arcuate; apical half scarcely noticeably, arcuately emarginate; before basal angle very broadly and shallowly but distinctly emarginate. Sublateral carina with inner edge sharp only on basal two-fifths. Surface of disk with granules about as coarse as facets of eyes or very slightly coarser and usually separated by 1 to 2 diameters; a short but very distinct (at 75×), subrecumbent, yellow seta arises from each granule; surface between granules microscopically punctate when not microscopically reticulate. *Hypomera* with plastron extending along entire lateral (dorsal) margin from apex to base. Plastron belt extending backwards to posterior margin about as wide as front tibia. Anterior plastron-free belt about as wide as widest part of front tibia. *Elytra* nearly 3 times as long as pronotum (1.55 mm: 0.55 mm). Fourth discal interval feebly subcarinate for a short distance on basal region. Discal strial punctures deep, round to subquadrate, about as broad as intervals, and usually separated longitudinally by their diameters or a little less. Surface of discal intervals sparsely, often indistinctly granulate; surface between granules usually more or less smooth; intervals with short but distinct, suberect, yellowish setae. Epipleura with plastron present everywhere from base to apex. Scutellum large, obovate, and surface more or less smooth. *Prosternum* with plastron extending to disk on a very broad front. *Metasternum* with disk nearly flat. Median longitudinal line present on about posterior three-fifths and not as broad as a tarsal segment. Surface of disk with granules like those of disk of pronotum. *Abdomen* with disk of first sternite not depressed; with a large, low, median tubercle on about anterior third; surface of tubercle with dense, golden hairs. Plastron absent only on anterior third to two-fifths of disk of first sternite. *Legs* with a row of fine teeth on inner side of middle and hind tibiae.

Female. Externally similar to male but without a row of fine teeth on inner side of middle and hind tibiae. In the single female seen the median longitudinal depression of the pronotum is longer and more distinct than in the male, and at about basal third on either side of the median depression there is a small but very prominent tubercle. The surface behind the 2 median tubercles has a wide patch of dense, short, erect setae (perhaps pheromone distributing setae).

Holotype male: BOLIVIA: Dept. Santa Cruz, Prov. Sara, Santa Rosa, at light, 21-II-1969, A. Martinez & R. E. Woodruff.

Paratypes. 1 male, 1 female, with same data as holotype.

NOTES ON THE MATING PERIODS OF SOME TIGER BEETLES (COLEOPTERA: CICINDELIDAE)

André Larochelle

Bourget College, C.P. 1000, Rigaud, Quebec, Canada

Tiger beetles of Quebec mate in the spring and summer. The following list of dates is for copulation of *Cicindela* observed in this province. Mating has been observed in the daytime only.

Cicindela ancocisconensis Harris: Nicolet Co., Bécancour, 5-VI-1971 (2 pair).

Cicindela duodecimguttata Dejean: Saguenay Co., Forestville, 15-VI-1971 (1 pair), and Rivière-Saint-Jean, 22-VI-1971 (1 pair).

Cicindela hirticollis Say: Saguenay Co., Magpie, 23-VI-1971 (1 pair).

Cicindela repanda Dejean: Nicolet Co., Bécancour, 5-VI-1971 (1 pair); Saguenay Co., Tadoussac, 14-VI-1971 (2 pair); Vaudreuil Co., Choisy, 1-VI-1971 (3 pair).

Cicindela scutellaris lecontei Haldeman: Ile-de-Montréal, Montréal, 27-V-1971 (1 pair), E. J. Kiteley.

Cicindela sexguttata Fabricius: Portneuf Co., Saint-Augustin-de-Québec, 18-V-1971 (2 pair), C. Chantal.

* * *

RHINANISUS CHISOSENSIS, A NEW SPECIES OF COSSONINE WEEVIL IN A GENUS NEW TO THE UNITED STATES (COLEOPTERA: CURCULIONIDAE)

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Abstract

The genus *Rhinanisus,* previously known from New Zealand, South and Central America, and the West Indies, is recorded for the first time in the U.S. A tiny new species was reared from the dead leaves of *Agave Havardiana* from Big Bend National Park, Texas.

The genus *Rhinanisus,* originally described by Broun (1883) from New Zealand, is now known also from South and Central America and the West Indies. The previous 9 New World species are all tropical. None were found north of Guatemala, while the present species is from the desert mountains of Big Bend National Park.

This small new species was taken breeding in the leaves of newly dead *Agave Havardiana* Trel. Larvae, pupae, and adults were collected from simple cave type galleries within the dead leaves, and they were reared within the leaves over nearly a 2 year period, which may indicate use of the same leaves for several generations over more than one year. Also specimens were collected in the field in newly dead leaves and in dead plants of the previous year.

Rhinanisus would key to couplet 3 in Kissinger's key (1964) to the genera of Cossoninae which may be modified as follows:

3. Head not constricted dorsally behind the eyes, eyes located on head .. 5
Head constricted and globular behind eyes, eyes located on head or apparently on base of rostrum 3a
3a. Eyes apparently located on base of rostrum, mature color black 4
Eyes located on head, mature color reddish brown .... *Rhinanisus*

Rhinanisus Broun 1883:489

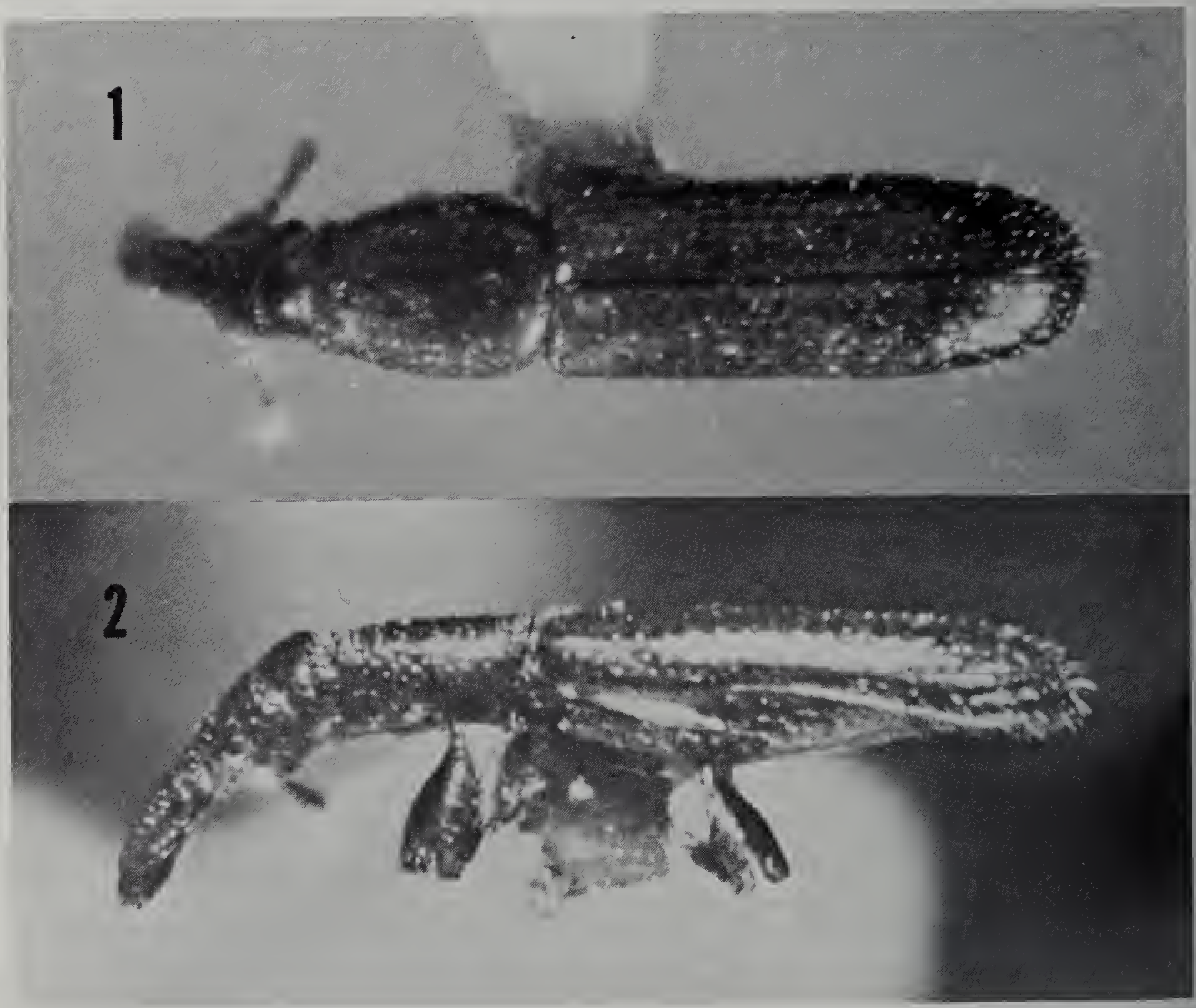
Small, elongate narrow, distinctly flattened; with distinct fine setae.

Rostrum longer than head, apical two-thirds suddenly wider than basal one-third. Scrobes lateral, directed toward lower margin of eye. *Head* constricted behind eyes, smooth and globular, eyes located on head. *Antennae* with 5-segmented funicle; scape reaching middle of eye. *Prothorax* distinctly longer than broad, strongly constricted near apex, flattened, distinctly pubescent. *Scutellum* large, triangular. *Elytra* elongate, flattened, pubescent; striae strongly punctate. *Tibiae* strongly uncinate.

Rhinanisus chisosensis O'Brien, NEW SPECIES

Small, elongate narrow, strongly depressed; strongly punctured, with dense fine setae; color reddish brown.

HOLOTYPE MALE: *Rostrum* continuous with frons; narrow, ca. two-thirds width of head, ca. 1.5 times as long as head; basal one-third strongly, coarsely, densely punctured; narrower than apical two-thirds, with moderately fine, dense, suberect, golden setae; apical two-thirds with median impunctate area, lateral areas coarsely, moderately, sparsely punctured with sparse, similar setae; broadest at apex and antennal insertion. Scrobes lateral, open behind. *Head* with apical area coarsely, densely punctured with dense, erect, golden setae; suddenly constricted, with base globular, glabrous, and scarcely punctate. Eyes moderately small, oval, coarsely faceted, moderately convex. *Antennae* with sparse, fine, suberect setae; with straight, short, stout scape, reaching just beyond middle of eyes; with 5-segmented funicle, 1st segment largest, 2nd half as wide and slightly shorter, segments 3, 4, and 5 much broader than long, progressively larger, club elongate oval, with dense, elongate, fine setae. *Prothorax* longer than broad, sides from base to apical one-third slightly rounded, then constricted and tubulate; coarsely, deeply, moderately densely punctured; with moderately dense suberect golden setae; median area distinctly impressed; median area of apex to constriction smooth and glabrous. Fully winged. *Scutellum* large, triangular, and glabrous. *Elytra* ca. 2.5 times as long as wide, sides subparallel, humeri subrectangular, apex broadly rounded; strial punctures large, elongate oval, deep, close together, separated by less than 0.5 their diameter; intervals flat, indistinctly alutaceous, with small coarse punctures, less than one-third diameter of strial



Figs. 1 and 2. *Rhinanisus chisosensis* O'Brien, sp. nov.; 1) dorsal view; 2) lateral view.

punctures; with moderately dense, suberect golden setae. *Venter* clothed moderately with suberect, fine, golden setae. Front coxae distinctly separated, by ca. one-third diameter of coxae; prosternum twice as long in front of coxae as behind; 1st abdominal segment slightly longer than 2nd, 3rd and 4th together much shorter than 2nd, subequal to 5th; 1st suture strongly emarginate medially, 2nd and 3rd straight; 1st and 2nd segments narrowly slightly concave at middle, 5th segment flat. *Legs* with stout, unarmed femora; tibiae broadened at apex, strongly uncinate. Tarsi with 3rd segment broadly bilobed, ventrally densely pubescent; 4th segment elongate, twice as long as 3rd.

Length: 1.8 mm; including head and rostrum 2.4 mm.

ALLOTYPE FEMALE: 1st abdominal suture not visible in median three-fifths; 1st segment flat, not concave; 5th segment distinctly convex. Length: 1.8 mm; including head and rostrum, 2.5 mm.

Holotype and allotype: Texas, Big Bend National Park, Green Gulch [Chisos Mountains], 5300 feet, 26-III-1970, L. & C. W. O'Brien, in leaves dead *Agave Havardiana*. [USNM]

Paratypes: same data,(6)[CWOB],(4)[USNM]; same data except date, 18-IV-1970 (70)[CWOB], (50)[USNM](20)[FSCA]; same data except date 3-VI-1970 (10)[BBNP], (20)[BMNH], (10)[CASC], (10)[CNCI], (100)[CWOB], (10)[ELSC], (20)[FMNH], (10)[TAMU], (40)[TTUC], (11)[USNM]; Big Bend National Park, Chisos Mountains, Maple Canyon, Elevation 5000 feet, 27-IV-1952, H. S. Dybas, leg.,(10)[FMNH], (2) [CWOB]. According to park rangers, Maple Canyon is now called Green Gulch so the specimens are all from the same locality. COLLECTION ABBREVIATIONS: [CWOB] Charles W. O'Brien, [USNM] U.S. National Museum, [BBNP] Big Bend National Park, [BMNH] British Museum of Natural History, [CASC] California Academy of Sciences, [CNCI] Canadian National Collection, [ELSC] E. L. Sleeper, [FMNH] Field Museum of Natural History (Chicago), [TAMU] Texas A & M University, [TTUC] Texas Tech University, [FSCA] Florida State Collection of Arthropods (Gainesville).

This species is not closely related to any North American Cossoninae and can be readily identified through its 5-segmented funicle, depressed elongate form, and suddenly constricted head behind the eyes. Its reddish brown color and distinct pubescence are also diagnostic.

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ECOLOGICAL NOTES ON *BRADYCELLUS SEMIPUBESCENS* LINDROTH (COLEOPTERA: CARABIDAE)

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In Quebec, *Bradycellus semipubescens* Lindroth occurs in deciduous woodland swamps near water, in somewhat shaded localities under bushes of *Acer, Alnus, Salix,* and *Rubus* on very moist soil, often mixed with humus under dead leaves and among heaps of grass. It has also been collected in rather wet meadows. Other associated ground-beetles are: *Bradycellus badipennis* Haldeman, *Bradycellus lugubris* Leconte, *Bradycellus nigrinus* Dejean, and *Agonum palustre* Goulet. Lindroth (1968, Ground-beetles of Canada and Alaska 5:649-944) recorded the ecology of *Bradycellus semipubescens* from a single specimen collected at Amberley, Ontario, "on a meadow flooded by a small brook".

* * *

GROUND-BEETLES COLLECTED IN A LIGHT TRAP IN SAGUENAY COUNTY, QUEBEC

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The following 25 species of ground-beetles were taken by me from 13 June to 23 July 1971, in Saguenay Co., Quebec, in a white light trap (the number of specimens shown in parentheses).

Agonum muelleri Herbst: Baie-Trinité (1).
Agonum propinquum Gemminger and Harold: Natashquan (101).
Amara aenea De Geer: Chute-aux-Outardes (1).
Amara erratica Duftschmid: Rivière-Saint-Jean (1).
Amara fulva De Geer: Baie-Trinité (1); Havre-Saint-Pierre (48); Magpie (3); Port-Cartier (1); Rivière-au-Tonnerre (2).
Amara lunicollis Schiödte: Baie-Trinité (1).
Bembidion bruxellense Wesmael: Havre-Saint-Pierre (1); Port-Menier (1).
Bembidion castor Lindroth: Moisie (1).
Bembidion immaturum Lindroth: Moisie (2).
Bembidion incrematum Leconte: Baie-Trinité (4); Chute-aux-Outardes (1); Forestville (1); Moisie (6); Port-Cartier (1); Rivière-Saint-Jean (1).
Bembidion occultator Notman: Brador (2); Middle Bay (2).
Bembidion petrosum Gebler: Moisie (1); Rivière-Saint-Jean (12); Tadoussac (2).
Bembidion transversale Dejean: Baie-Trinité (9); Rivière-Saint-Jean (2); Rivière Vauréal (3); Tadoussac (1).
Bembidion versutum Leconte: Havre-Saint-Pierre (1).
Blethisa multipunctata Linné: Natashquan (25); Port-Menier (3).
Blethisa quadricollis Haldeman: Natashquan (1).
Bradycellus semipubescens Lindroth: Chute-aux-Outardes (1).
Clivina fossor Linné: Tadoussac (1).
Elaphrus americanus Dejean: Baie-Trinitè (7); Havre-Saint-Pierre (11); Moisie (2); Port-Menier (6).
Harpalus fuliginosus Duftschmid: Havre-Saint-Pierre (1); Rivière à la Patate (1); Rivière Jupiter (1).
Harpalus nigritarsis C. R. Sahlberg: Rivière-au-Tonnerre (1).
Harpalus pleuriticus Kirby: Baie-Trinité (1); Moisie (4); Port-Cartier (2); Rivière-Saint-Jean (2).
Loricera pilicornis Fabricius: Baie-Trinité (1); Chute-aux-Outardes (1); Havre-Saint-Pierre (1).
Metabletus americanus Dejean: Mingan (1).
Trechus rubens Fabricius: Baie-Trinité (1); Havre-Saint-Pierre (1); Rivière-au-Tonnerre (1); Rivière-Saint-Jean (1).

* * *

ECOLOGICAL NOTES ON *PODABRUS* (COLEOPTERA: CANTHARIDAE).

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Abstract

Ecological notes are recorded from observations made during collecting trips throughout western U.S. during the last few years. To these have been added the sparse published notes. Specific subjects discussed are: unexplainable aberrant behavior; foliage preferences in different areas; feeding habits; moisture requirements; temperature or humidity; escape mechanisms; and ambiguous associates.

Introduction

There are few published notes on the habits of the family Cantharidae. Most of these have been merely records of feeding on aphids. In some of these, the species were misdetermined. The few notes I have been able to find offer little more than an introduction to these habits.

Wood (1883) noted that the Cantharidae, although being soft bodied, are among the most quarrelsome of insects and, at the least provocation, fight to the death. He stated that it was the custom for boys to catch these beetles and set them to fighting, the winner eating the loser after killing it (regardless of species or sex). I have never observed this phenomenon.

Adults of *Podabrus* are generally collected from foliage, by sweeping grasses and low herbage, or by beating branches of shrubs and trees. Mani (1968) mentioned that the Palearctic *Podabrus obscuripes* Sahlb. was found under stones on crowberry (*Empetrum*) meadows above timberline. He mentioned that *Podabrus lateralis* LeC. had been found at elevations up to and above 3960 meters on the Rocky Mountains of Colorado.

Early Stages

Larvae of *Podabrus* are largely carnivorous. Those of some species are abundant in the debris of the forest floor. This is particularly true in coniferous forests. Those of others may be found in the ground among grass roots. They all have a velvety covering of fine hairs and may be gray to brown and yellowish to pink.

Payne (1916) mentioned that the fine hairs of the larvae of *Cantharis lituratus* Fallen permit them to live for a long time in water. The same is probably true for the larvae of *Podabrus,* a genus closely allied to *Cantharis.*

Essig (1926) noted that the eggs of *Podabrus tomentosus* (Say) (actually *P. pruinosus* LeC.) are oblong, pale yellow, and laid in masses on or in the soil where larvae live. Larvae are 15 to 20 mm long, pink with 2 dark lines on the dorsum of the thoracic segments, and have a velvety cover of fine hairs. The pupae occur in a cell 3 to 6 inches deep in the ground. The misidentification was based on LeConte's (1881) conclusion that *P. pruinosus* was synonymous with *P. tomentosus.* Fall (1928) confirmed the validity of the former. *P. tomentosus* occurs from New Jersey to Kansas and South Dakota, whereas *P. pruinosus* is found from the Rocky Mountains to the Pacific Coast.

Feeding Habits of Adults

On 15 July 1970, I observed a specimen of *Podabrus piniphilus* Esch. feeding on a large species of woolly homopteron at Twin Bridges Forest Camp, Mount Hood National Forest, Oregon. As it was being collected it did not release its prey. These woolly homopterans were fairly abundant on alders (*Alnus sp.*). Blatchley (1910) noted a specimen of *Podabrus rugosulus* LeC. (*P. rugulosus* Auct.) feeding on a winged aphid. Essig (1926) reported *Podabrus comes* LeC. (currently considered a color variety of *pruinosus*) feeding on aphids and common in Arizona, California, Oregon, and Montana. He also mentioned *P. tomentosus* (Say) (*P. pruinosus* LeC.) freely feeding on all kinds of aphids in California and Oregon. Smith (1936) reported several species of *Podabrus* at times effectively controlling the mealy plum aphid, *Hyalopterus pruni* (Geoffroy), in California. Clausen (1940) mentioned many species of *Podabrus* feeding extensively on aphids. Jacques (1951) reported that *Podabrus rugosulus* LeC., *P. modestus* (Say), and *P. tomentosus* (Say) were valuable aphid destroyers. The first 2 are found in the eastern half of the U. S., and the latter species is known from east of the Rocky Mountains.

The following observations were made on collecting trips during the last few years. They are more or less ecological in character but with incongruities that challenge comprehension. The short time at any one locality and the small amount of equipment makes almost all results inconclusive. Collections were made in the western states from the east slope of the Rocky Mountains to the Pacific Ocean and from the southern half of British Columbia to the Mexican border. Most of my trips were in the company of my son, William. In the spring of 1969, a trip to the San Bernardino and southern Sierra Nevada Mountains of California was taken with Mr. Frank Beer of Oregon State University.

Moisture

Podabrus species are usually found most abundantly adjacent to, or comparatively close to, some water source, such as lakes, streams, meadows, etc. Beyond a half mile from such a water source, the species become decidedly scarce or absent. This is especially true of montane species which are most common on foliage directly over the water. Due to the propensity of these montane species for higher elevations and an adjacent water source, their consequent isolation and speciation have created taxonomic problems. *Podabrus* are generally rather heavy flyers, and they apparently do not move far from their place of origin. The problem of speciation has been especially evident in the southwest where the mountain ranges have broken up into isolated mountain groups separated by comparatively wide expanses of dry plains and deserts.

Near Onyx Summit, San Bernardino Mountains, California, 28-VI-1969 (8000 feet), the weather was quite warm. Late in the afternoon, Frank Beer and I collected along a small stream flowing over a gravelly bed. Along the margins were grasses, flowers, and a rather low willow (*Salix* sp.) in clumps. *Podabrus gracilis* Fall was common on the willow branches overhanging the creek, but they were absent on the side of the willows away from the water.

On the same day, along the Santa Ana River at Seven Oaks, San Bernardino Mts., Cal. (5300 feet), several species of *Podabrus* were taken. The most abundant were *P. gracilis* and an undescribed subspecies of *Podabrus pruinosus* LeC. While a few were collected from alders (*Alnus* sp.), most were on grasses and herbs overhanging, or growing out of, the water. The beetles were frequently so near the water that sweeping or beating was difficult, and hand picking was the easiest way of collecting them.

At Union Creek Forest Camp near Crater Lake National Park, Oregon, 28 June 1967, low alders and vine maples (*Acer circinatum* Pursh.) were densely overhanging the creek. My son, Bill, collected numbers of *Podabrus lygarius* Fender by wading in the ice cold water and beating the overhanging branches, while I collected only 2 or 3 on the landward side.

TEMPERATURE

On extremely warm days, *Podabrus* tend to become inactive during the hottest part of the day. Where they go during this time is not known.

A favorite collecting area of mine for years has been the Metolius River on the eastern edge of the Cascade Range in Oregon. The rather narrow valley cut by the river gets hot on sunny summer days. Then *Podabrus* are active in the late morning, after the dew is gone; and in the late afternoon, as the day begins to cool. In the interim they disappear. This pertains to all species of *Podabrus* found here, the more common of which were *Podabrus piniphilus* Esch., *P. instabilis* Fall, *P. cavicollis* LeC., *P. pustulatus* Fend., and *P. cascadensis* Fend.

At Kaibab Lake Forest Camp, Kaibab National Forest, Arizona, 27 June 1968 (about 7000 ft.) and Cave Spring Forest Camp, Oak Creek Canyon, Arizona, 28-29 June 1968 (5000 ft.), the days were very hot (reported 119° F at Phoenix on the 28th). Only 2 specimens of *Podabrus* (sp. undet.) were taken during 3 days, and these were flying slothfully. However, at night they were fairly abundant at the lantern set up to attract insects. An all-out effort to find them during the daytime failed. At Kaibab Lake, the water was very low and remote from any vegetation. It may be that humidity, rather than temperature, is the limiting factor.

A number of *Podabrus* seem to be less affected by cold. At Huntington Lake, Fresno County, California, 1 July 1969 (6950 ft.), the weather was so cool that, in the shaded areas where snow banks still existed, I was shaking from the cold. Despite the chill, beating the evergreen trees overhanging a small creek produced several specimens of *Podabrus gracilis* Fall. They were almost invariably on the shaded portions of the trees.

FOLIAGE SELECTIVITY

Blatchley (1910) recorded the following: *Podabrus tomentosus* (Say) abundant on the great ragweed (*Ambrosia trifida* L.) along borders of streams; *P. brunnicollis* Fab. beaten from oak, hickory, and wild grapes; *P. frater* LeC. sweeping herbage in low moist places.

In some areas, *Podabrus* species display a proclivity for the foliage of a certain species of plant. In other areas, the same species will prefer an entirely different plant, although the original plant is present and even dominant (e.g., *Podabrus lateralis* LeC.). This is a high altitude species of the Rocky Mountains (9,000-13,000 ft.) and is frequently associated with *Podabrus obscureovitatus* Fall.

In the Cedar Breaks country of southern Utah, I collected at timberline (11,000 ft.) on Brian Head. *P. lateralis* was abundant on the leeward side of clumps of spruce (*Picea engelmanni* Engel.), but they were absent from herbs and shrubs. The intersection of the Brian Head road with the Cedar Breaks-Parowan highway (10500 ft.) lies in a flat, damp, upland grassy area of considerable extent. Here a number of small isolated spruce groves occur (all similar in size). The trees were all heavily infested with a pale green species of aphid. On some of the groves, *P. lateralis* was common along with a species of *Cephaloon* (Cephaloidae). On adjacent groves, both species were absent, although there was no apparent difference between the groves.

Below Cedar Breaks (to the south) lies Midway Valley, the floor of which is a damp grassland with a small stream running through it. The sides of the basin are bordered by spruce forests. In this area, *P. lateralis* was abundant on the trees at the edge of the forest. A few more were also swept from the grasses bordering the stream. There were none on the grasses near the trees.

Avintaquin Forest Camp, Ashley National Forest, Utah, is on a large, wet, upland meadow, surrounded on 3 sides by dense spruce forests. Occasional isolated trees or tree clumps intrude on the meadow. On 30 July 1967, *P. lateralis* was almost exclusively confined to one isolated tree in the meadow. The tree was not as remote from the forest as some others nor as close as still others. There was no apparent food supply on that tree that was not to be found on neighboring trees. Sweeping the meadow was unproductive.

Los Conchos Picnic area, Jemez Mountains, New Mexico (9000 ft.), has a small stream along it with a wet meadowy area on one side in a fir, cedar, and spruce grove with branches of the trees overhanging the stream. The meadow is composed of reeds, grasses, lupines, and other unrecognized flowering plants. On 18 July 1968, *P. lateralis* was abundant on the plants of the meadow but absent from the branches of the trees. Unfortunately, I did not ascertain whether the beetles were confined to one species of plant.

Red River Pass, Carson National Forest, New Mexico (9800 ft.), has a small creek running through a narrow meadow. On 20 July 1968, sweeping this meadow produced a few *P. lateralis*. On the south side of the meadow is a dense spruce forest, the trees of which are small and close. Beating the branches of the margins of the forest also produced a few *Podabrus*. Nowhere were they common. About a mile west of Red River pass and about 300 feet lower, is a small rather open lateral draw with a temporary stream flowing through it in a small aspen grove. There was a sparse shrub area of young spruce, fir (*Abies* sp.), wild rose (*Rosa* sp.), and gooseberry (*Ribes* sp.). The herb layer was pretty well dried up. On the same day, *P. lateralis* and an undetermined *Podabrus* were beaten from the fir, rose, and gooseberry. Spruce and the herb layer yielded nothing.

Two days were spent above the Rocky Mountain Biology Laboratory, Gothic, Colorado, 23-24 July 1968. Bill and I camped at Avery Park Forest Camp. The first day was wet and cold with lightning storms in the higher mountains. Collecting was soggy and difficult and no *Podabrus* were found, despite considerable searching. The next morning cleared somewhat, and it was warmer. Our camp at 9,600 ft. was on the edge of a spruce-fir-aspen forest. Along the margin of the forest was a zone of lower, rather sparse willows on the edge of a large upland meadow through which meanders the upper reaches of the East River. Although all habitats were searched, *P. lateralis* and *Podabrus obscureovittatus* Fall were taken only on the willows.

Emerald Lake (10,000 ft.), a couple of miles north of Avery Park, has a bordering margin of willows at the lower end. Below this is a very wet marshy area of considerable size, in which are occasional hummocks on which are veritable hedges of low spruce. From this marshy area, at least one branch of the East River apparently originates. Along the margins of this incipient stream other willows are found. Again *P. lateralis* and *P. obscureovittatus* were found only on the willows.

About a mile beyond Emerald Lake, and on the north side of Schofield Pass (10700 ft.), is a small upland and a stream, along which were willows, spruce, fir, and a small upland glade of grasses and herbs. In this spot, *P. lateralis* and *P. obscureovittatus* were taken by beating spruce and sweeping the herb layer. Here the willows were destitute of *Podabrus.*

Mizpah Forest Camp, Arapaho National Forest, Colorado (9500 ft.), is in a spruce forest. Through one side of the camp ground flows Clear Creek. Along the banks of the creek and overhanging the banks are spruce, 2 species of willows, and other trees. The weather on 26-27 July 1968 was cool and showery, leaving the foliage wet most of the time. *P. lateralis* was abundant, but only on one species (undetermined) of willow.

Dumont Lake Forest Camp, Routt National Forest, Colorado (9,300 ft.), was warm and sunny on 29 July 1968. Our camp was about 1/4 mile from the lake and in a small spruce grove on a sloping rocky hillside. There were other similar spruce groves on the hillside. There were indications that the area might have burned over a number of years ago. *P. lateralis* and *P. obscureovittatus* were sparsely beaten from the spruce. The edges of the lake had narrow bands of sedges and reeds encroaching in the water. On these, *P. lateralis* was abundant, but *P. obscureovittatus* was absent.

Grout Bay Campground, Big Bear Lake, San Bernardino Mountains, California, was hot and dry on 25 June 1969. Frank Beer and I collected along a small creek that ran through a clutter of large to vast boulders, shrubs, criss-crossed logs, and dead branches in a narrow ravine that made collecting very difficult. *Podabrus gracilis* Fall was common on the lower branches of the shrubs directly above the water, making the collecting still more difficult. Later, Frank collected several specimens of *P. gracilis* from a single fir (*Abies concolor*) tree on a hillside several hundred feet from the creek. This was the only fir tree that yielded specimens, although Frank tried many more. He indicated that he could find no appreciable difference between that particular fir and neighboring firs.

Escape Mechanisms

Near Seven Devils Road, about 2 miles south of Charleston, Coos County, Oregon, *Podabrus lygarius* Fend., were seen flying around and landing on an isolated spruce tree (*Picea sitchensis* (Boug.) Trautv. and Mayer). One specimen landed on a twig, crawled awkwardly over the needles for a brief time, and settled down on a needle (its head at the base of the leaf and its body paralleling it). In this position of repose, it closely resembled the neighboring needles. Had it not been observed prior to settling down, it would have been virtually impossible to espy.

Cozine Creek, McMinnville, Oregon, runs through the middle of our acreage in a pasture land with one or two springs on it. Grasses and reeds abound, with brier patches of blackberry and wild rose encroaching thereon. Along the creek are willows and ash (*Fraxinus oregana* Nutt.). In April 1970, *Podabrus pruinosus* LeC. and *P. piniphilus* Esch. were observed on tall grasses. The most common resting position was with the head down or toward the base of the leaf. The beetles would fly in clumsily and alight with their heads up or toward the tips of the grass blades. After wandering up and down the blades for a bit, they settled down with their heads toward the base of the leaf or stem more than 75 percent of the time. In this head down position, the beetles were much more difficult to capture than in an upright position. They were much more willing to let go of the leaf and drop to safety, as though they could more readily see where they were falling.

This same reaction was observed at Devil's Garden, Deschutes National Forest, Oregon (6000 ft.) with *Podabrus danielsi* Fend. On 16 July 1970, they were collected by sweeping low sparse sedge clumps in a very wet upland meadow. Although few were observed, 3 specimens were found resting on the sedges in a head down position. From this position they dropped immediately (upon collector movement in their direction). Another specimen was seen to fly in and land on a sedge. While still moving around and in a heads up position, it was comparatively easily captured.

AMBIGUOUS ASSOCIATES

As mentioned before, at the intersection of the Brian Head road with the Cedar Breaks-Parowan highway, *Podabrus lateralis* and an undetermined species of *Cephaloon* were collected together from certain spruce groves, whereas they were both absent from other similar groves with no apparent explanation.

In a number of instances, species of the genus *Chasmatonotus* (Diptera: Chironomidae) have been observed running around on the same trees or shrubs from which *Podabrus* were usually collected in large numbers. They were also on plants that had no *Podabrus*. There is no evidence of any particular association between these flies and the beetles. It is probable that the *Chasmatonotus* are more noticeable because they run rapidly over the leaf surface. In addition, I was once particularly interested in this genus of flies.

At Prairie Creek Redwoods State Park, Humboldt County, California, 20 June 1969, Frank Beer and I collected an undetermined (not saved) species of *Chasmatonotus* along with *Podabrus pruinosus* along the Ten Taypo trail.

On 14 July 1969, at Mount Hood Meadows (timberline), on the east side of Mount Hood, Oregon (5650 ft.), the principal plants were willows, fireweed (*Epilobium angustifolium* L.), lupines, mountain hemlock (*Tsuga mertensiana* (Bong.) Sarg.), alpine fir (*Abies lasiocarpa* (Hook.) Nutt.), sedges, false hellebore (*Veratrum viride* Ait.), indian paint brush (*Castilleja* sp.) and goldenrod (*Solidago* sp.). *Podabrus lygarius* was collected by beating willows and sweeping the shorter herbage. *Chasmatonotus maculipennis* Rempel was abundant on the willows.

On the same day, at the junction of the Mount Hood Meadows road with the Mount Hood Loop highway (5000 ft.), we collected in a thick forest of mountain hemlock, alpine fir, huckleberry (*Vaccinium* sp.), false hellebore, vanilla leaf (*Achlys triphylla* (Smith) DC) and sedges along a small mountain rill. *P. lygarius* was collected from the hemlock and huckleberry by beating with no attempt at sweeping. *Chasmatonotus univittatus* Coq. was common on huckleberry and vanilla leaf.

At Still Creek Forest Camp on the south side of Mount Hood, the same day (4000 ft.), *P. lygarius* was collected from the foliage of the creek margin along with *Chasmatonotus maculipennis*. Still Creek is a mountain stream in a previously dense forest in which the camp sites have been cut and cleared, with alders, elderberry (*Sambucus glauca* Nutt.), gooseberry (*Ribes* sp.), brake fern (*Pteridium aquilinum* ssp. *pubescens* Underw.), horsetail (*Equisetum* sp.), thimbleberry (*Rubus parviflorus* Nutt.) and cow parsnip (*Heracleum lanatum* Mich.) on its margin. The forest is cedar, mountain hemlock, alpine fir and douglas fir.

Many more instances could be cited but they would be largely repetitious.

Summary

During collecting trips over the last 4 years, daily logs were kept. From these logs emerged patterns of behavior, of which some could be partially correlated with temperature and moisture requirements. Others indicated foliage preferences that vary from area to area. There also occur inconsistencies to the patterns that are at present unexplained. Although incomplete, I feel that these findings should be made available at this time. Hopefully they are only a beginning toward a more complete knowledge of *Podabrus*.

Acknowledgments

I wish to express my appreciation to the National Science Foundation for their support of this and other studies with their grant, GB-6283X; to Frank Beer of Oregon State University and my son William, who accompanied me on trips and diligently collected for me; to my daughter, Mrs. Laura McCarley, who helped plan and arrange the paper; and to Dr. Jane C. Dirks-Edmunds for her critical examination and helpful suggestions.

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Book Notice: *At a bend in a Mexican River*, by George Miksch Sutton. 1972. Paul S. Eriksson, Inc., 119 W. 57th St., New York, N. Y. 10019. 8½ × 11", 184p., 30 paintings (12 in color), 17 photos; cloth, $14.95.

Although oriented toward birds, the beautiful illustrations and the interesting text will thoroughly whet the appetite of any beetle collector who has conducted field work in Mexico.—R. E. Woodruff

XYLEBORUS HOWDENAE, NEW NAME, AND SOME CORRECTIONS TO "THE SCOLYTIDAE AND PLATYPODIDAE OF JAMAICA."

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In my recent paper "The Scolytidae and Platypodidae of Jamaica" (Bull. Inst. Jamaica, Science Series 21, 1972) several errors and omissions were made that should now be corrected.

The name *Xyleborus novus* Bright is preoccupied by *Xyleborus novus* Eggers, 1923, from Mentawei Island near Sumatra. I therefore rename my species *Xyleborus howdenae,* New Name, in recognition of Mrs. H. F. (Anne) Howden who collected many of the specimens used in my study.

While my manuscript was in press, W. H. Anderson and D. M. Anderson (Smithsonian Contrib. Zool. 94, 1971) published a paper in which numerous lectotypes were designated from specimens in the United States National Museum of species described by Hans Eggers. Among them is *Stephenoderes intersetosus* Eggers. On page 53 of my paper, I also designated a lectotype for this species from the Schedl collection (Lienz, Austria). My lectotype designation should be disregarded because of Anderson and Anderson's previous designation. This species has since been placed as a synonym of *Hypothenemus eruditus* Westwood (Wood, 1972, Great Basin Nat. 32(1):47).

Two species should be added to the Jamaican list: *Tricolus perdiligens* Schedl (1950, Dusenia (3):171) and *Hypothenemus africanus* (Hopkins) (Wood, 1972, Great Basin Nat. 32(1):43). With the synonymy mentioned above and the addition of 2 additional species, the total number of species of Scolytidae and Platypodidae known from Jamaica is 70.

I wish to express my sincere appreciation to Mr. F. G. Browne, Middlesex, England for bringing the homonym of *Xyleborus novus* to my attention.

* * *

NOTES ON GROUND BEETLE ODORS

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Several Carabidae are known to give off odors when alarmed or captured: *Amara brunnipennis* Dejean, *Calosoma calidum* Fabricius, *Calosoma scrutator* Fabricius, *Harpalus caliginosus* Fabricius, *Microcosmus flavopilosus* Laferté, *Nomius pygmaeus* Dejean, *Psydrus piceus* Leconte, *Pterostichus ater* Dejean, *Scaphinotus angusticollis* Mannerheim, *Scaphinotus viduus* Dejean, and *Trechus chalybeus* Dejean.

During several recent captures (QUEBEC: Saguenay Co., Baie-Sainte-Claire, Blanc-Sablon, Brador, Chevery, Harrington, Lourdes-de-Blanc-Sablon, Middle Bay, Moisie, Natashquan, Port-Cartier, Port-Menier and Rivière Jupiter), *Pterostichus punctatissimus* Randall regularly emitted a strong odor reminiscent of burnt chocolate when handled. Ross T. Bell has noticed the same odor in Vermont. The odor requires application of water and soap to remove it from the fingers.

A REVISION OF THE GENUS *DROMANOMMA* WASMANN, WITH A DESCRIPTION OF ITS BEHAVIOR AND THE POSSIBLE MECHANISMS INTEGRATING IT INTO ANT SOCIETIES (COLEOPTERA: STAPHYLINIDAE)[1]

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Abstract

The genus *Dromanomma* is redescribed and illustrated for the first time. The only previously known species, *D. hirtum,* is redescribed and 2 new species, *D. kuehnei* (Zambia) and *D. setosa* (Ghana), are described. The behavior of *D. kuehnei* is described, morphological details of the setae are shown, and the results of a gland survey are given. The genus *Dromanomma* is interpreted as a persecuted but integrated myrmecophile which relies on its shape, its eyesight, tactile cues from specialized setae, thick exoskeleton, and defense glands for its success in exploiting the driver ant colony, probably as a brood predator.

The genus *Dromanomma* was first described by Wasmann (1916) from a single specimen and, so far as I know, the genus and single species was known only from this specimen up to the present. During a field trip in 1970, we were fortunate to capture a large series of a new species. We were also able to study its interactions with the ant hosts. Later we were able to study the internal anatomy and found another new species among some material from Ghana collected by Dr. Endródy-Younga of the Hungarian National Museum, Budapest. The purpose of this paper is to present the results of these studies.

The taxonomic methods used in this paper have been described many times, most recently by Kistner (1968). Behavioral studies were made by studying the beetles in the ant columns and in petri dishes accompanied by ant workers. Sections (5μ) were made of paraffin (melting point 63°-65° C.) imbedded material which were then stained using the Matsuo

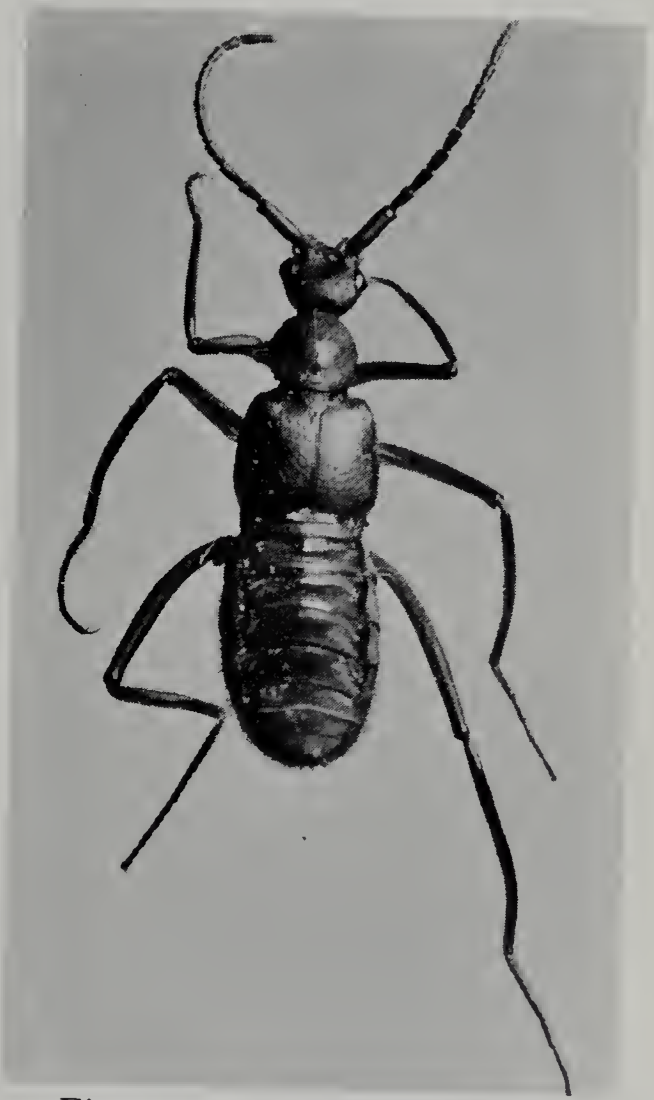

Fig. 1. *Dromanomma kuehnei,* dorsal view of entire beetle.

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[1] Partial support by the National Science Foundation (Grant GB-28661X) is gratefully acknowledged.

tetrachrome technique. To get the electron micrographs shown here, a specimen was vacuum coated with gold to a thickness of 150-200 A for viewing with a Japan Electron Optics Scanning Electron Microscope (JSM-S1). Measurements are in mm unless otherwise stated.

Genus *Dromanomma* Wasmann

Dromanomma Wasmann 1916:97; Seevers 1965:280 (listed).

Distinguished from *Pagonogastria* Bernhauer by the shape of the mouthparts, as well as the presence of thick spatulate setae on the under side of the abdomen and meso- and metasternum. Wasmann (loc. cit.) compared the genus to *Ocyplanus* Fauvel to which it is related, but easily distinguished by the overall shape of the body (Fig. 1).

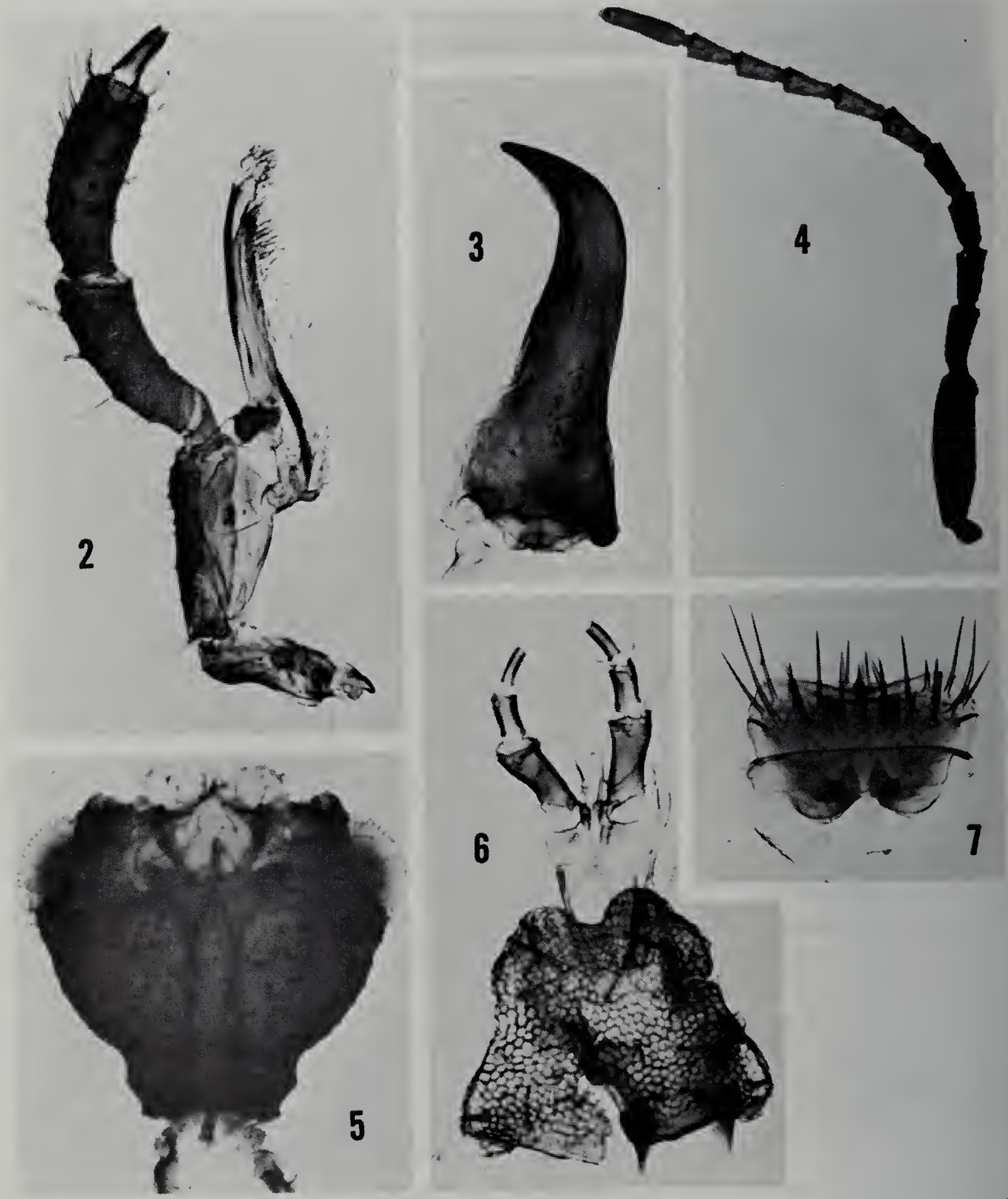

Fig. 2-7. *D. kuehnei*: 2) maxilla; 3) right mandible; 4) antenna; 5) head, ventral; 6) submentum and labium; 7) labrum.

Head capsule subtriangular, length behind eyes about equal to distance from anterior border to frons. Head capsule produced behind into distinct neck; also with distinct nuchal ridge (Fig. 5). Antennae inserted between eyes just lateral to insertion of arms of anterior tentorium. Gula long with sides relatively straight; fused to submentum which broadens out anteriorly. Mentum distinct from submentum, shaped as in Fig. 6. Antennae 11-seg-

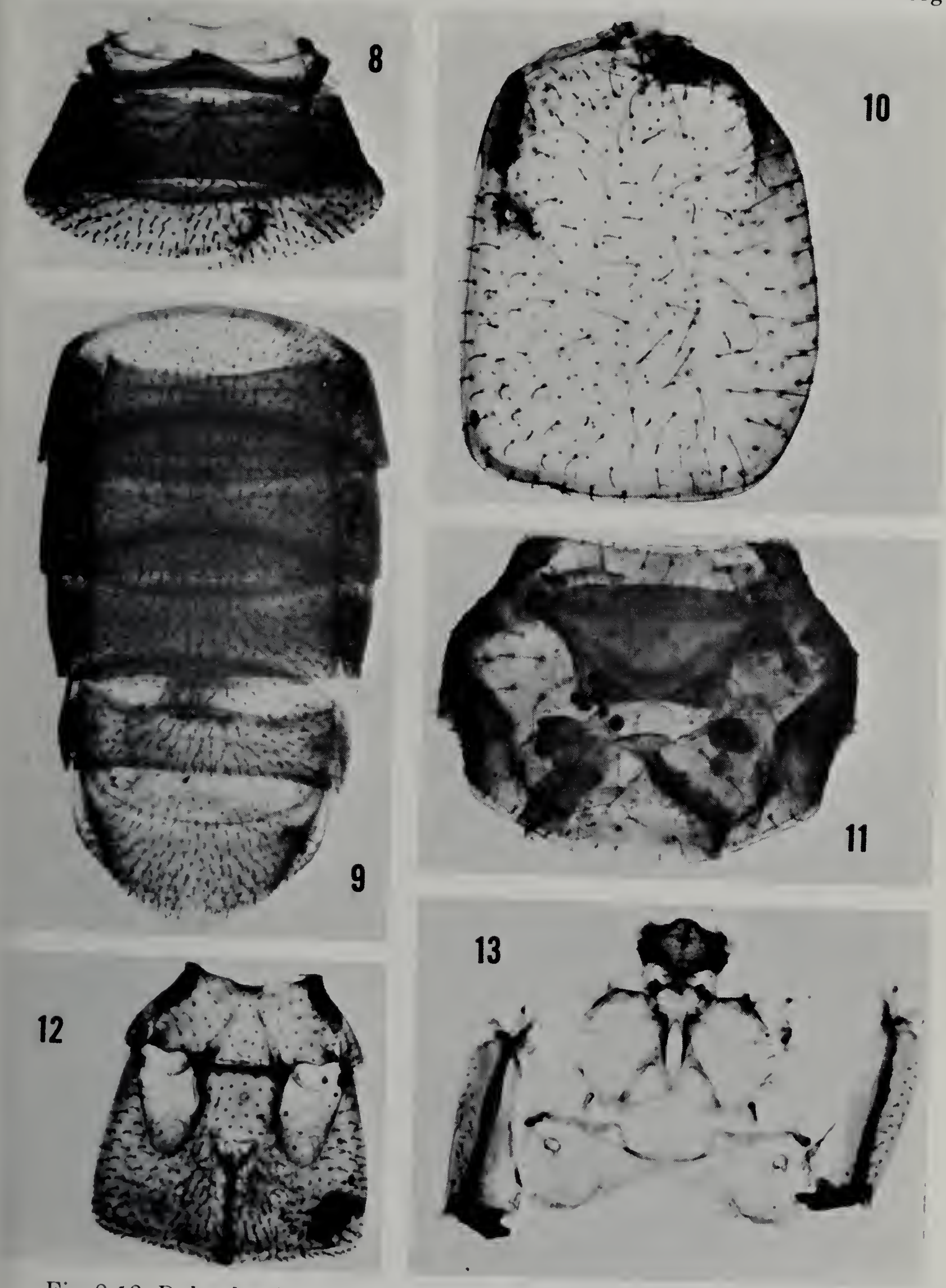

Fig. 8-13. *D. kuehnei*: 8) abdominal segments II-III; 9) abdominal segments IV-VIII; 10) elytron; 11) pronotum and prosternum; 12) meso- and metasternum; 13) meso- and metanotum.

mented, shaped as in Fig. 4. Mandibles nearly symmetrical (Fig. 3); note elongate shape and lack of median teeth. Maxillae shaped as in Fig. 2; palpi 4-segmented. Maxillary acetabulae distinctly margined. Labium shaped as in Fig. 6; palpi 3-segmented. Labrum shaped as in Fig. 7.

Pronotum wider than long, shaped as in Fig. 11, with lateral margins produced into median bulges, anterior margin and posterior border evenly rounded laterally. Prosternum relatively long, about one-third pronotal length, heavily sclerotized, evenly rounded between legs, shaped as in Fig. 11. Anterolateral pronotal articulation processes relatively short. Procoxal cavities closed behind by membrane in which are located heavily sclerotized mesothoracic peritremes. Meso- and metanotum shaped as in Fig. 13. Mesosternum about 0.5 × length of metasternum, shaped as in Fig. 12. Mesocoxae relatively widely separated by broadly produced metasternal process. Mesocoxal acetabulae distinctly margined. Metasternum with many spatulate setae. Mesosternum with only a few spatulate setae. Elytra shaped as in Fig. 10. Wings present, of normal size with usual staphylinid venation; subbasal plate present with many setae. Pro-, meso-, and metalegs shaped as in Fig. 15, 14, and 16 respectively; tarsal formula 4-5-5. Number of spatulate elytral setae vary among species. Spatulate setae frequent on coxae of metalegs, less frequent on coxae of mesolegs, and few on coxae of prolegs.

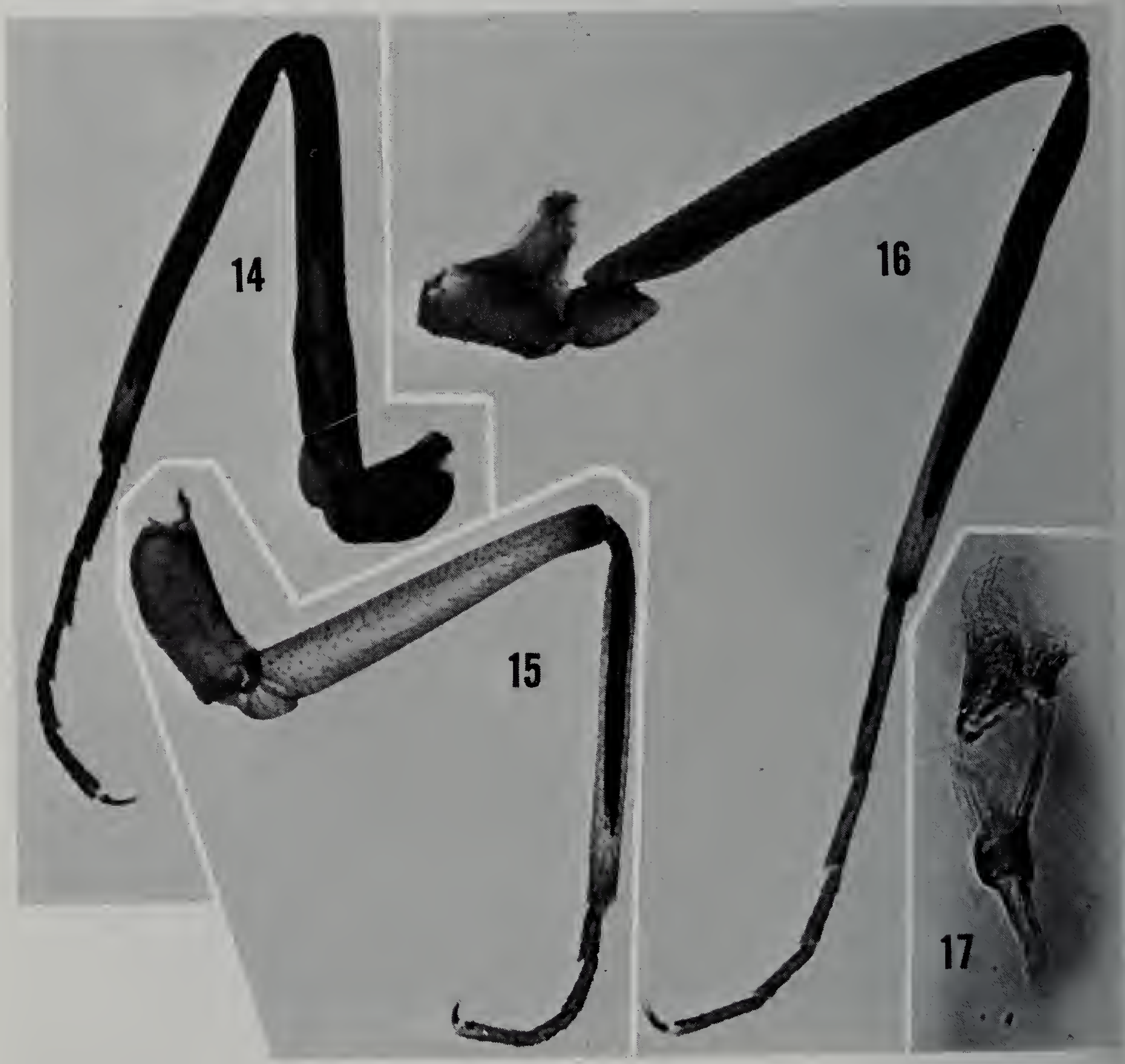

Fig. 14-17. *D. kuehnei*: 14) mesoleg; 15) proleg; 16) metaleg; *D. setosa*: 17) spermatheca.

Abdomen subconical, shaped as in Fig. 1, 8, and 9. Segment I represented by tergite fused to the metanotum. Segment II represented only by a tergite. Segments III-VI with 1 tergite, 1 sternite, and 2 pairs of paratergites each. Inner and outer paratergites about equal in width on most segments. Segment VII with but 1 pair of paratergites, and with a sclerotized tergal gland opening in anterior rim of dorsal border. Segment VIII represented by tergite and sternite only. Dorsal abdominal margin occurs between sternites and outer

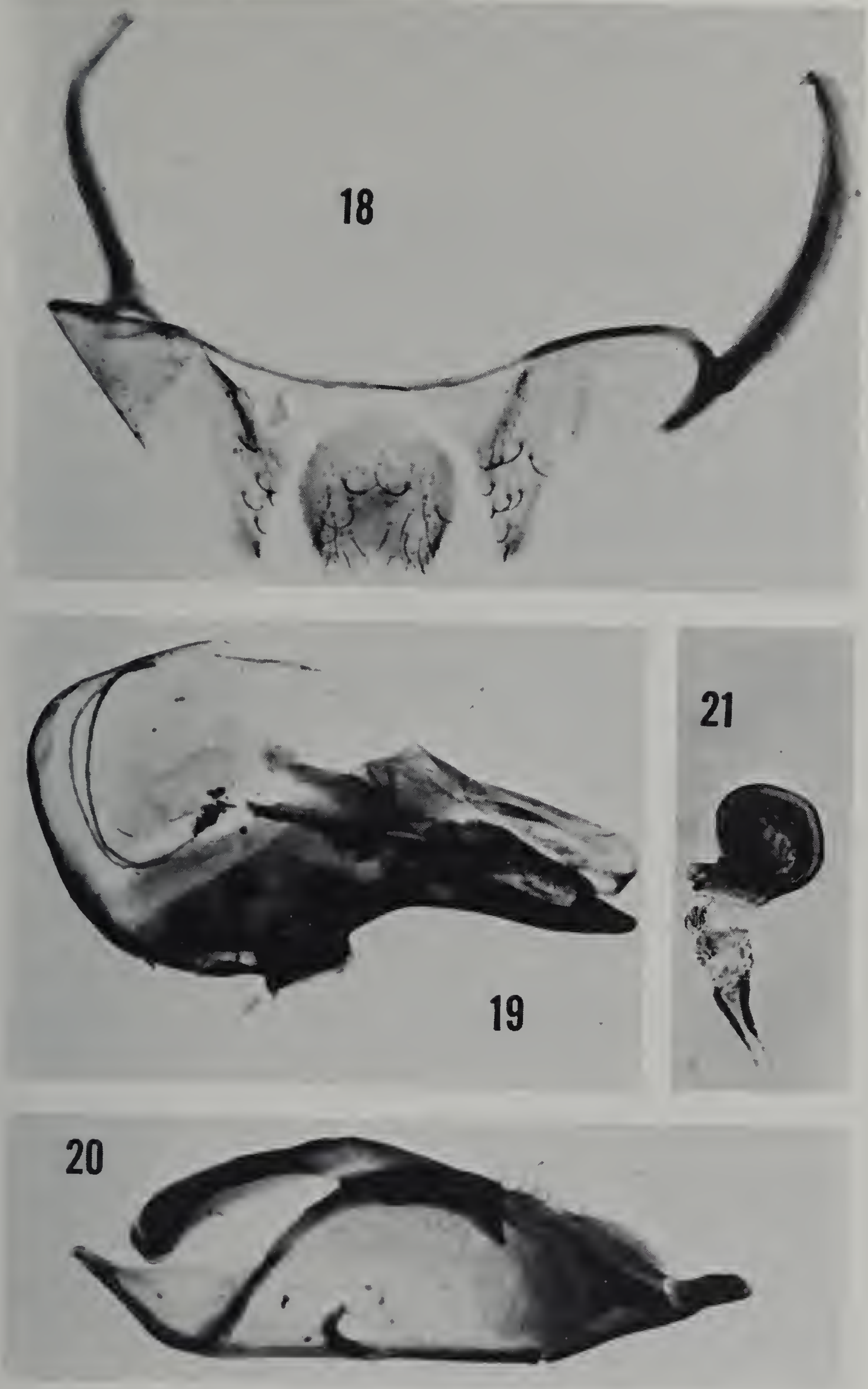

Fig. 18-21. *D. kuehnei*: 18) abdominal segment IX of male spread out; 19) median lobe of male genitalia; 20) lateral lobe of male genitalia; 21) spermatheca.

paratergites. Segment IX trilobed, shaped as in Fig. 18, anterior apodemes of male strongly conspicuous. Segment IX of male with an extra elongate piece present; probably representing sternite of segment IX. Male genitalia bulbous, shape presumed variable among species; lateral lobe shaped as in Fig. 20. Female spermatheca sclerotized, shape variable among species. Only sternites have conspicuous spatulate setae, paratergites and tergites having only fine regular pointed setae. Tergite VII with 3 openings to glands, 1 on each side of midline about one-third distance in from each edge, and a median opening on center of segment closer to midline. Spiracles on segments II-VI contained in deep wells with fimbriate edges.

TYPE SPECIES: *Dromanomma hirtum* Wasmann (by monotypy).

KEY TO SPECIES OF *DROMANOMMA*

1. Pronotum with distinct midline suture; long setae from the sides of the abdomen equal in length to about one-third abdominal width .... *D. hirtum* Wasmann
1′. Pronotum without midline suture; long setae on abdomen equal in length to about one-fifth abdominal width 2
2(1′). No spatulate setae on elytra .... *D. kuehnei* n. sp.
2′. Spatulate setae on elytra .... *D. setosa* n. sp.

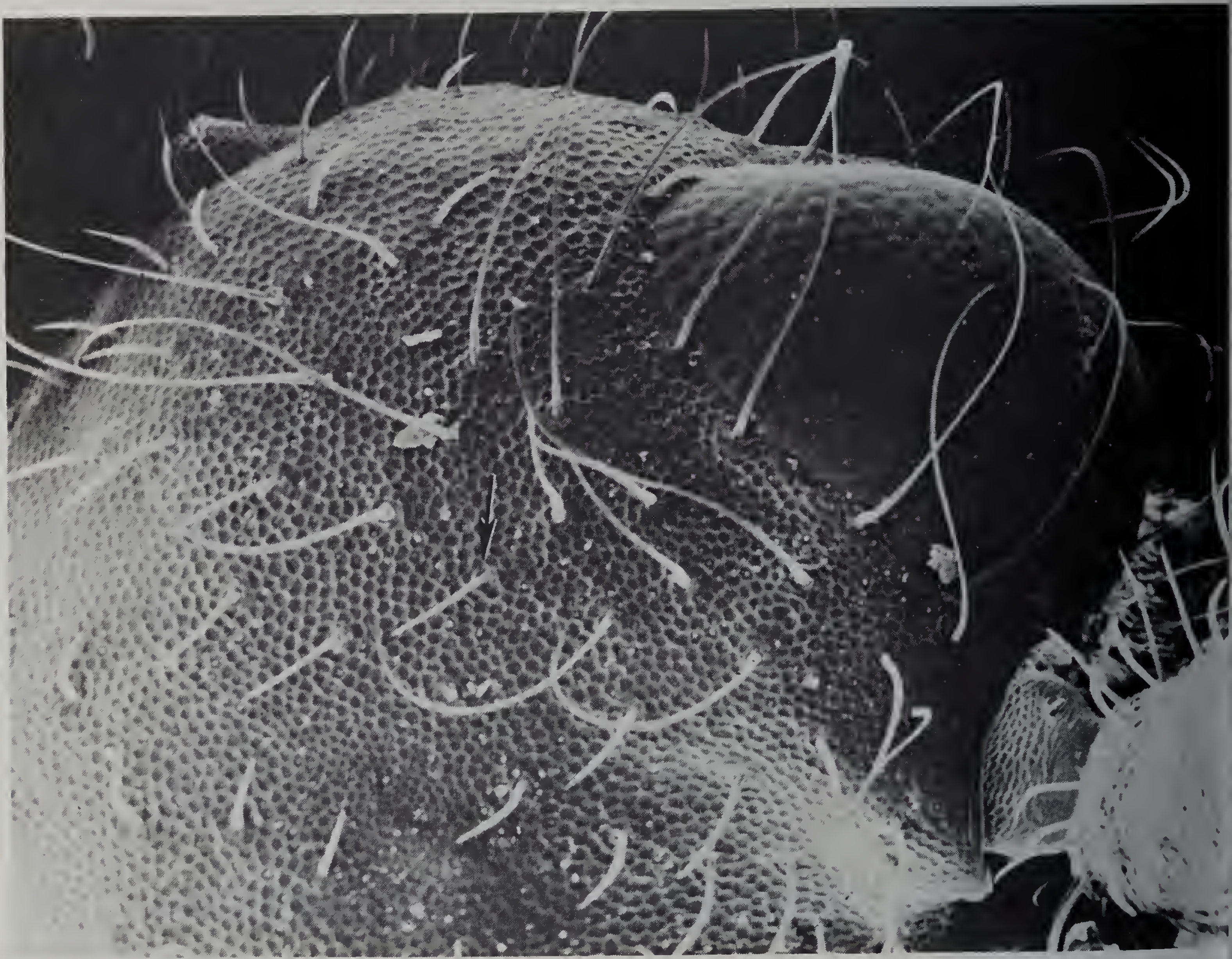

Fig. 22. *D. kuehnei*: Electromicrograph of a portion of the head, X 120. Arrow indicates seta which is enlarged in Fig. 23-24.

Dromanomma hirtum Wasmann

Dromanomma hirtum Wasmann 1916:98, Naturhistorisch Museum, Maastricht, (Congo Republic, St. Gabriel near Stanleyville, 1910, P. H. Kohl with *Dorylus (Anomma) wilverthi* Em.); Seevers, 1965: 280, (listed).

Related to *D. kuehnei* from which it is distinguished by the presence of a distinct midline suture and setae which are longer in proportion to the width of the abdomen than in *kuehnei.*

Color reddish brown throughout. Entire dorsal surface reticulate, producing a coarse shagreening. Head, pronotum, elytra, and abdomen, in fact entire body clothed with long curly setae which emerge at regular intervals, particularly from dorsal surface but also from ventral surface. These setae long, best described as equal in length to one-third abdominal width (ie., most setae

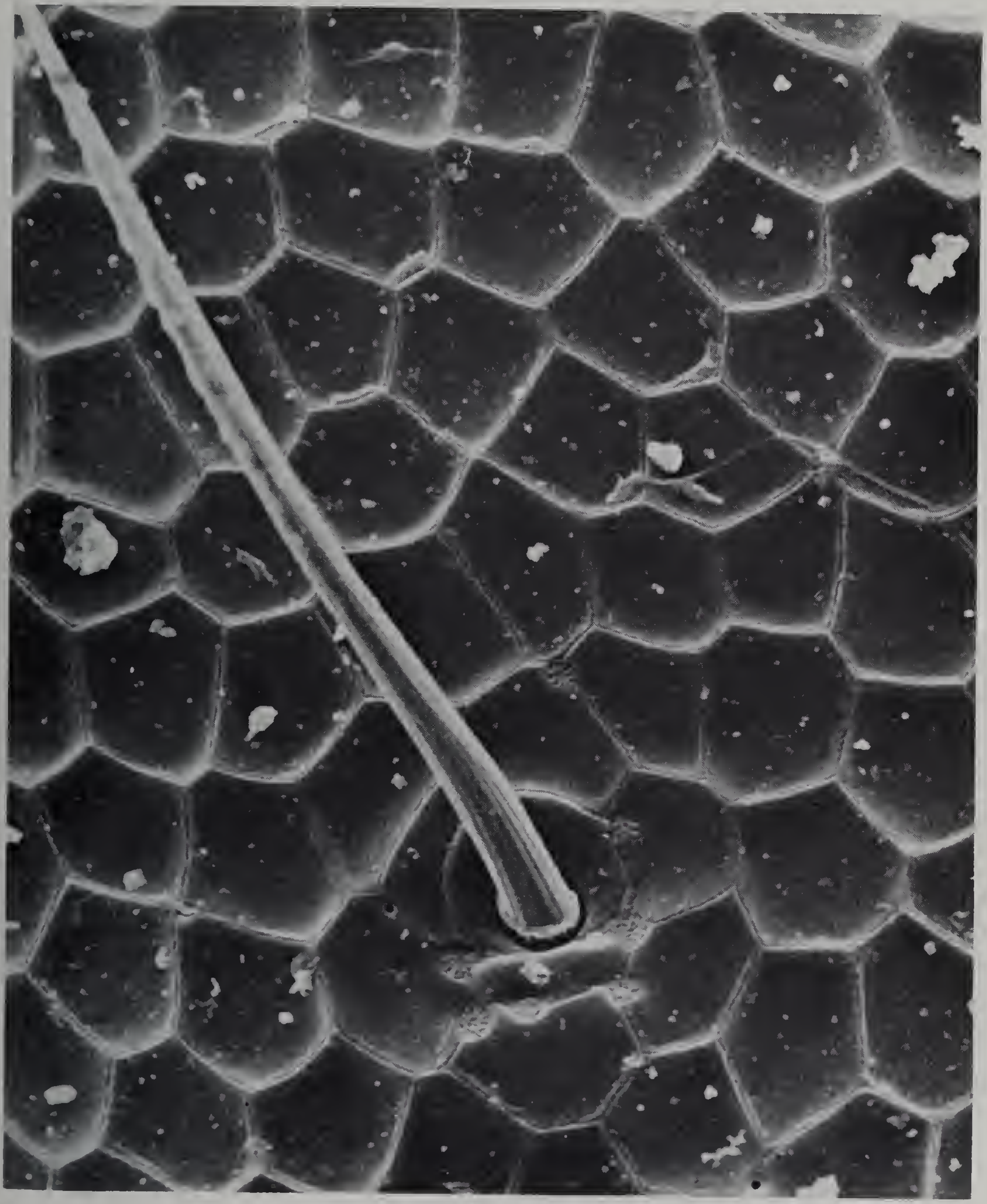

Fig. 23. *D. kuehnei*: Electromicrograph of 1 seta from head region X 600.

are this length). Ventral surface also contains very unusual spatulate setae noted in generic description. Pronotum with distinct midline suture. Male genitalia and female spermatheca presently unknown but presumed to be specifically distinct.

MEASUREMENTS: Pronotal length 0.88; elytral length 0.89. Number measured: 1.

MATERIAL EXAMINED: Only the holotype [NHM].

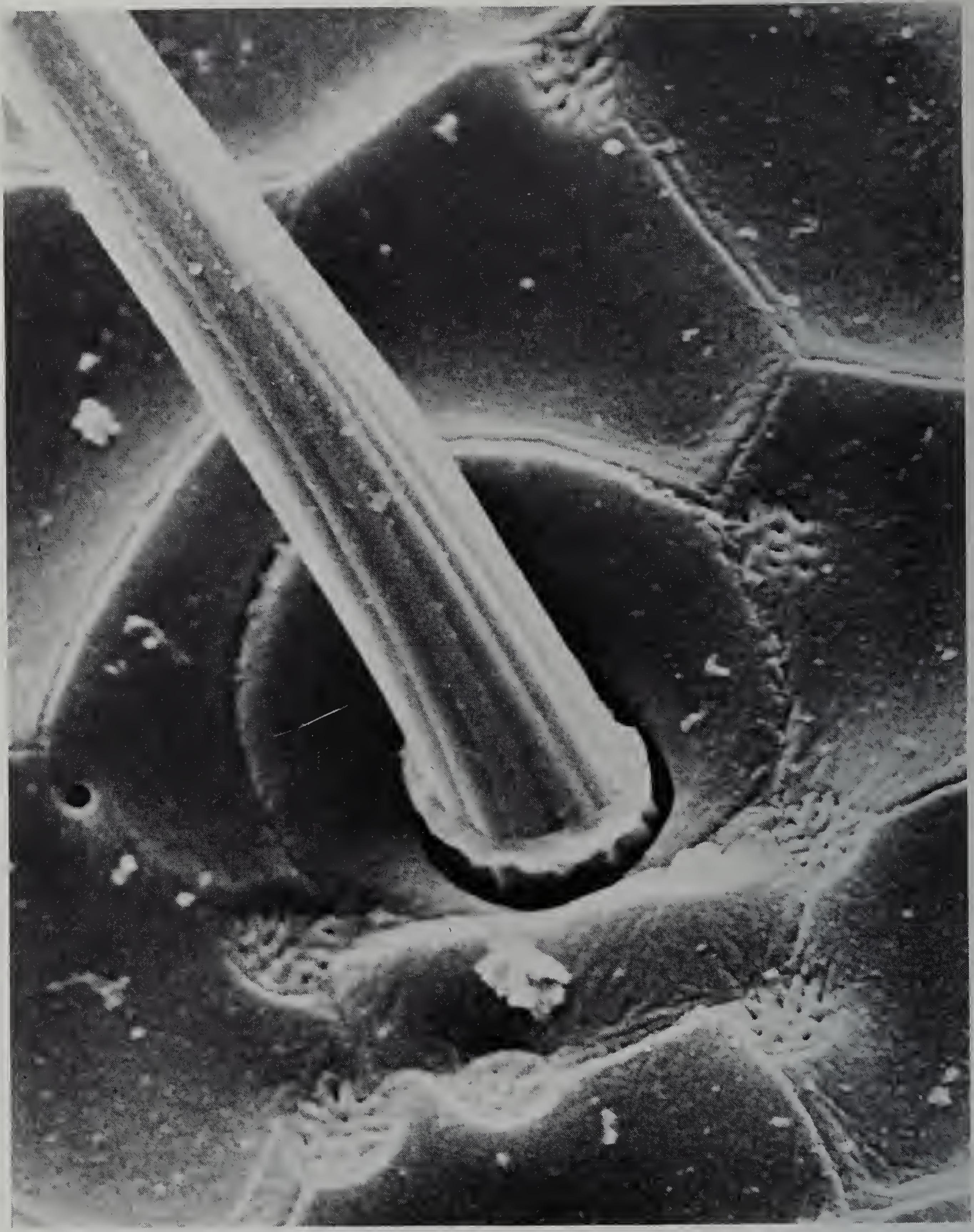

Fig. 24. Further enlargement of base of same seta shown in Fig. 22-23. X 1800.

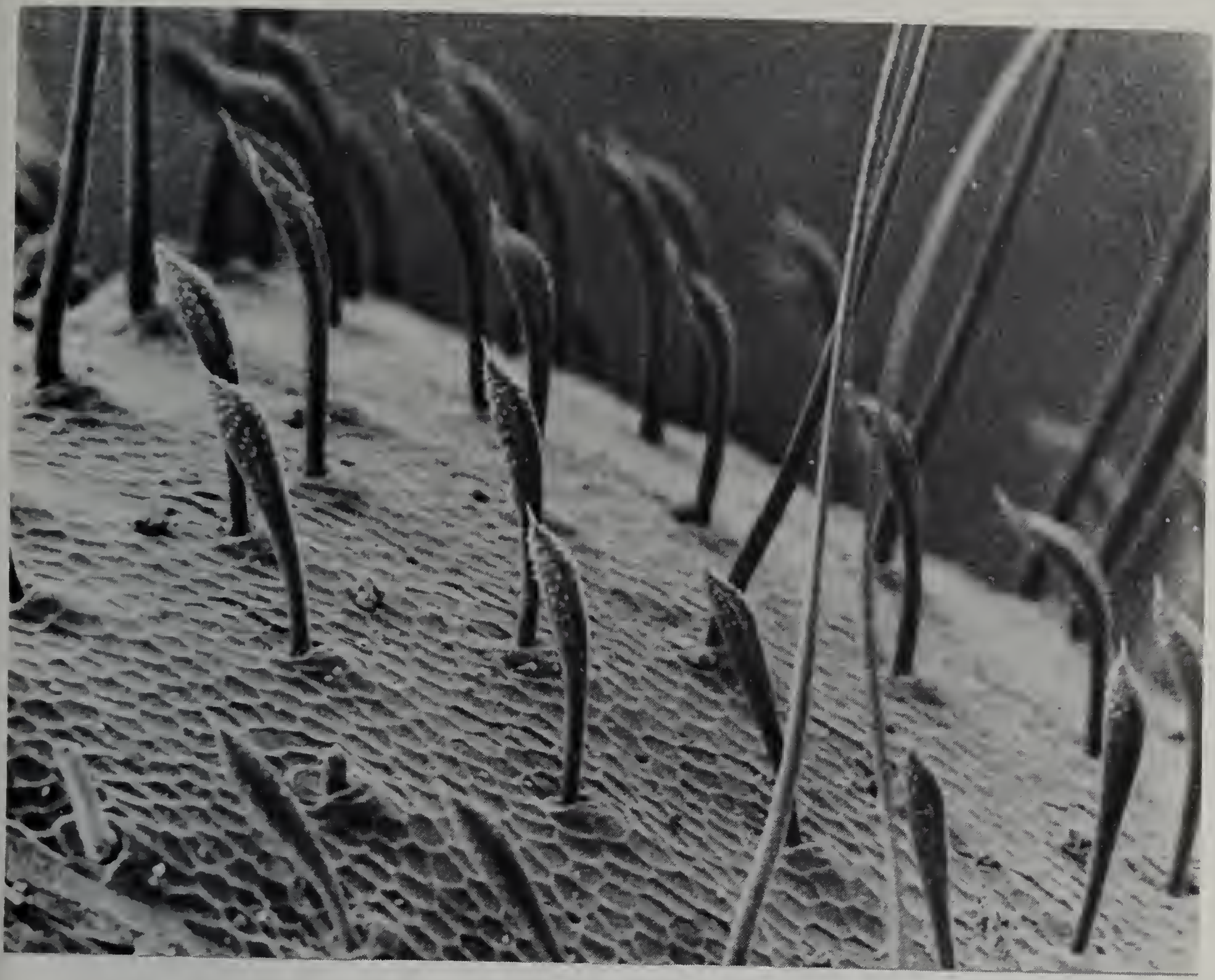

Fig. 25. *D. kuehnei*: Electromicrograph of lateral portion of abdominal sternite V showing 2 types of setae, the spatulate types and the regular long setae. X 150.

Dromanomma kuehnei Kistner, New Species

(Fig. 1-16, 18-25)

Related to *D. hirtum*, from which it is distinguished by the absence of a distinct pronotal midline suture, the presence of shorter setae over the body, and the pronotal length relatively shorter than the elytral length.

Color reddish brown throughout. Entire dorsal and ventral surface with reticulation which produces effect of shagreening. Pronotum without midline suture. Entire body clothed with covering of long yellow setae which are equal in length to about one-fifth abdominal width. Ventral portions of body also with black spatulate setae noted in generic description. Elytra without spatulate setae. Median lobe of male genitalia shaped as in Fig. 19. Spermatheca shaped as in Fig. 21.

Measurements: Pronotal length 0.82-0.88; elytral length 0.88-0.93. Number measured: 10.

Holotype: No. 14096, Zambia, Mbala, 17 May 1970, ex emigration column, central, nest #169, J. R. Clover, D. H., A. C., A. H., and K. M. C. Kistner [D. H. Kistner].

Paratypes: 25, same data as holotype, [DHK]; 15, same locality, nest, and collectors, collected 18-21 May 1970, [DHK].

Notes: This species is named for Mr. Karl W. Kühne, Director of the International Red Locust Control Service, who was very helpful to us in our searches for the driver ants while we were in Mbala. I determined the host ants as *D. (A.) wilverthi* Em., and specimens were deposited in the Gotwald and Kistner collections.

Dromanomma setosa Kistner, New Species

(Fig. 17)

Related to *D. kuehnei* from which it is distinguished by the presence of numerous spatulate setae on the elytra, as well as the shape of the female spermatheca.

Color light reddish brown throughout. Entire dorsal and ventral surfaces with reticulation which produces effect of shagreening. Pronotum without midline suture. Entire body clothed with covering of long yellow setae equal in length to about one-fifth abdominal width. Ventral portions of body thickly clothed with black spatulate setae as noted in generic description. Elytra with thick covering of spatulate setae interspersed between long yellow setae. Male genitalia unknown. Spermatheca shaped as in Fig. 17.

Measurements: Pronotal length 0.86; elytral length 0.85. Number measured: 1.

Holotype: #14292, Ghana, Brong-Ahafo Reg., Bui Camp, 130 meters, 8° 17′ N, 2° 15′ W, 1-4 Dec. 1965, ex light trap, Coll. S. Endródy-Younga, No. 101 [Hungarian National Museum].

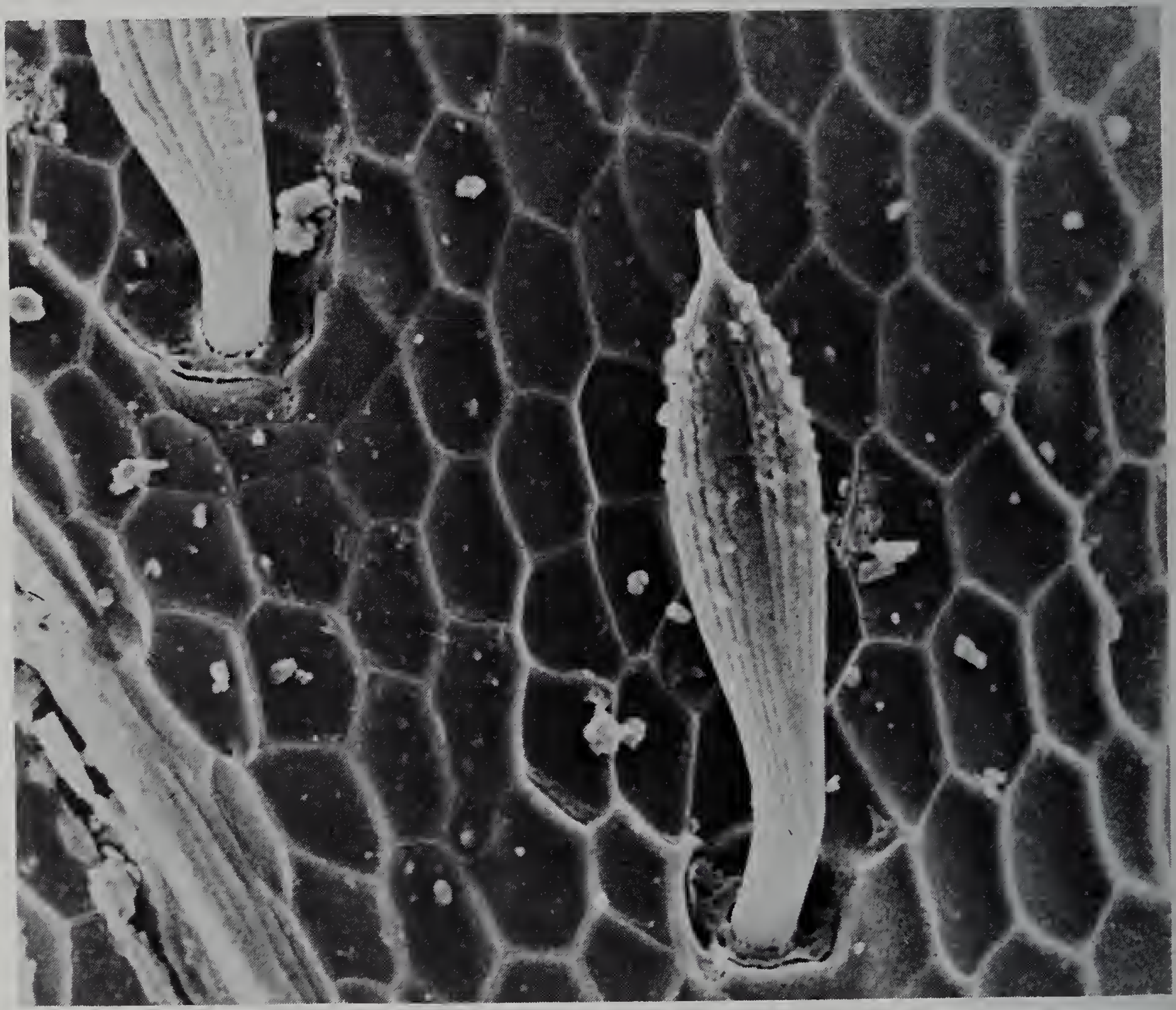

Fig. 26. *D. kuehnei*: Spatulate seta of Fig. 25 further enlarged, showing bases, X 500.

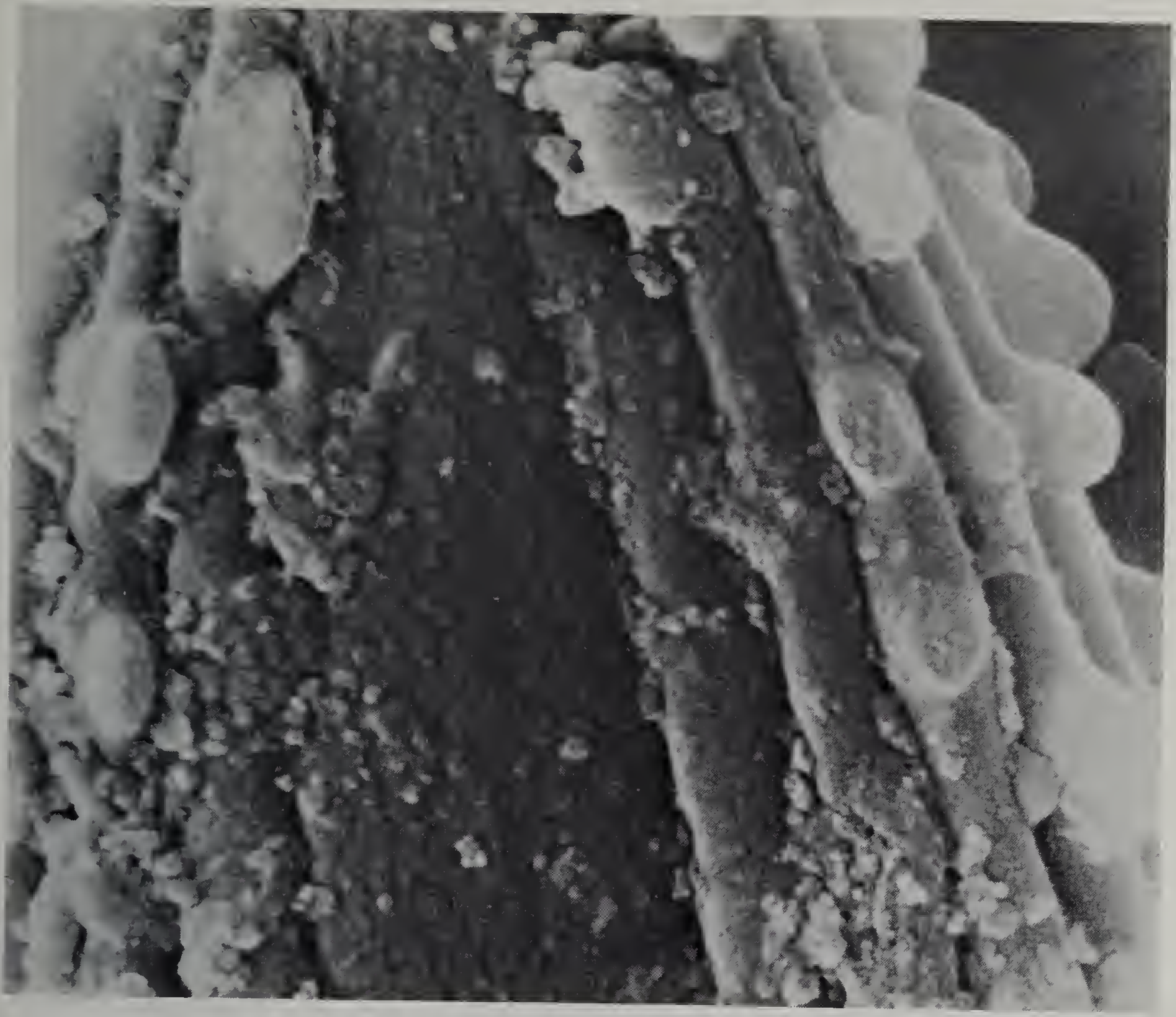

Fig. 27. *D. kuehnei*: Portion of spatulate setae shown in Fig. 26 further enlarged. X 5,000.

Behavior

While Wasmann thought *Dromanomma* exhibited a mimetic appearance to the ants based on its "ant-like" body and very long legs and antennae, he never reported any behavioral observations of Kohl, the collector.

In the columns, *Dromanomma kuehnei* was seen only when ant excitement was highest. The majority (26 of 41) were taken only when the column was thick with ants carrying larvae in an emigration. The others were taken under conditions when ant activity was intense, just before or after larvae were moved or when there was abundant booty being moved through the column. The beetles were right in the central part of the column with the ants, larvae, and/or booty. They moved along with their abdomens flexed at the same place as similar sized ants. They would thus fit my definition of a well integrated form (Kistner 1966).

However, even in the columns, if the beetles stopped we observed antagonistic ant encounters. We then placed some specimens with the ants into petri dishes with moist toweling for footing. After allowing them about an hour to settle down, we watched the beetles in their encounters with the ants; most encounters were antagonistic. An ant approached a beetle from any direction with its mandibles open. Just before the mandible crushed shut, the beetle dashed forward or backward, thus eluding the ant, even at close quarters. Beetles always walked with abdomens flexed over their back whenever ants were around. Over 80 encounters followed the above pattern. Five encounters were different in that the ants got their mandibles around the beetle. The beetle then unflexed its abdomen, whereupon the ant dropped it.

No feeding of the beetle by the ants was observed nor was any begging behavior observed. No fights occurred wherein the beetle subdued and/or ate an ant.

MORPHOLOGY

Using the behavior as a guide, the external and internal anatomy was studied to see what clues might be provided about the integration of the species into the ant colony. The setae of this genus are particularly distinctive, so the 2 main types were examined with the SEM. The more usual type of setae found on Aleocharinae is shown in Fig. 22 (head of *Dromanomma kuehnei*). Note that though the length varies, these setae have a similar structure. The structure of the marked seta in Fig. 22 was then followed at higher magnification (Fig. 23 and 24). As the magnification increases, numerous cribriform sensillae can be seen associated with the base of the seta. There are few (in the figure, only 1) cribriform sensillae among the cuticular polygons that are not near setae. These generalized setae, with their associated sensillae, are found on all surfaces of the body.

The unusual setae which are characteristic of this genus can be seen in Fig. 25 (from the lateral edge of abdominal sternite V). As 1 of these is enlarged (Fig. 26) note that they have the cribriform sensillae at their bases. The very high magnification (Fig. 27) shows details of the rounded structures on the setae. These setae are most numerous on the sternites of the abdomen, on the metacoxa, and on other parts of the thoracic sternites, but they decrease in number from posterior to anterior. The dorsal side of *D. kuehnei* have very few of these setae. This seems to vary somewhat among species (e.g., *D. setosa* has some on the elytra but there are far fewer on the dorsal than on the ventral surface in any case).

The survey for glands of possible significance in ant-myrmecophile interactions yielded very few. *D. kuehnei* had the usual maxillary glands, postpleural glands, and spermathecal glands. There was a distinct scarcity of type 1 or type 2 cells as found in many termitophilous species (Pasteels 1968, Kistner and Pasteels 1969). The only large glandular development was under abdominal tergites VI and VII where there were 2 distinct types of reservoirs as shown in Fig. 28, together with gland cells opening into the reservoirs. The median reservoir opened through a new opening in the mid-dorsal anterior edge of tergite VII (Fig. 28). This reservoir is filled with a substance which is

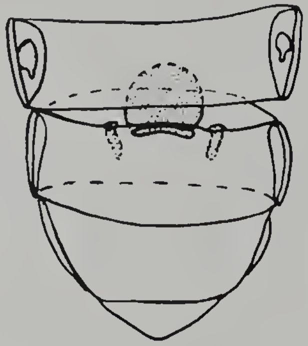

Fig. 28. *D. kuehnei*: Abdominal segments VI, VII, and VIII, dorsal, showing the location of gland reservoirs (stippled areas).

fixed in FAA (made with Isopropanol) and which stains orange with the Matsuo technique, indicating that the preserved secretion mass is acidophilic. The other type of reservoir is lateral to the median reservoir (Fig. 28) on each side and much smaller. Whatever secretion may be in the lateral reservoirs is not fixed in isopropanylic FAA.

Additionally, the exoskeleton is extremely thick in this genus, measuring between 0.035 and 0.050 mm thick in most non-articulating surfaces. This is about 2.5 to 3 times as thick as the exoskeleton in most free-living staphylinids. Even with the extra thick sclerotization, many specimens (in spite of careful collecting procedures) showed missing legs, nicks in the edges of sclerites, etc.

INTERPRETATION

Putting together the evidence from the behavior and morphology of the species, it appears that *Dromanomma* leads a somewhat harried existence in the driver ant colony. It makes its way through the columns by mimicing the ant motions, and the superficial resemblance to ants (as noted by Wasmann) probably helps satisfy whatever tactile cues the ants use to discover intruders. When detected as an intruder, the beetle uses extra tactile cues from the ventral surface of the abdomen which is held flexed so that it is functionally dorsal. I believe that these tactile cues are provided by the highly modified setae rather than by the cribriform sensillae which are present near all setae. The use of these cues plus excellent eye sight is sufficient to elude aggressive ants in most instances.

In the rare instances where the ant gets its mandibles around the beetle, a defensive secretion is probably emitted which functions as a repellent. I believe this secretion comes from either the small reservoirs or the large median reservoirs or both. The thick chitin probably also helps to protect the beetle during these rare dangerous encounters.

The presence of the beetles near the larvae suggests that they are brood predators. The beetles have large eggs (as seen in section) and we cannot even speculate where the unknown larvae spend their time. One specimen was captured at light so they can fly and are attracted to light.

ACKNOWLEDGEMENTS

I wish to thank: Mr. Karl Kühne, Director, International Red Locust Control Center, Mbala (Abercorn), Zambia for permitting use of the facilities of his institution during our field work in Mbala; Professor J. K. A. Van Boven, Universiteit Leuven, for permission to study the type of *D. hirtum* Wasmann in the Wasmann collection in the Naturhistorisch Museum, Maastricht; Dr. Z. Kaszab and Dr. Endrődy-Younga of the Hungarian National Museum for permitting me to study their Ghana collections; Mr. S. Pinson, JEOLCO, San Bruno, Calif. for the electron micrographs presented here. The following Shinner Assistants provided technical assistance on this study: William Blackburn, Daniela Davison, Jan Fischer, Joy Goodwin, Herbert Jacobson, Joseph Martin, Nancy Piastuch, Riley Swift, and Angela Vendsel, all of California State University, Chico.

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WING-DIMORPHISM IN *PATROBUS LONGICORNIS* SAY (COLEOPTERA: CARABIDAE)

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The hind-wings of *Patrobus longicornis* are usually vestigial, but 14 specimens have been seen from Illinois, Iowa, Kentucky, Massachusetts, Michigan, New York, South Carolina, Washington (Darlington, P. J. 1936. Variation and atrophy of flying wings of some carabid beetles. Ann. Ent. Soc. Amer. 29:136-179), Newfoundland (Lindroth, C. H. 1955. The carabid beetles from Newfoundland. 12:1-160) and North Carolina (Lindroth. 1969. Ground-beetles of Canada and Alaska. 6:945-1192). I examined 386 specimens from Quebec and found 16 fully-winged specimens from the following localities: Abitibi Co., Lac Chicobi, 2-VII-1968 (1 female, 1 male); Lebel-sur-Quévillon, 16-VII-1968 (1 female); Mancebourg, 18-VI-1968 (1 female). Argenteuil Co., Ile Carillon, (1 female, 1 male). Charlevoix-Est Co., Baie-Sainte-Catherine, 27-VI-1969 (1 female). Gaspé-Ouest Co., Mont-Albert, 3-VIII-1965 (1 male). Ile-de-Montréal, Montréal, 8-VII-1967 (1 female). Iles-de-la-Madeleine Co., Ile au Loup, 5-VIII-1970 (2 females). Lévis Co., Lauzon, 5-VIII (1 female). Montcalm Co., Saint-Emile-de-Montcalm, 17-VIII-1966 (1 female). Saguenay Co., Grandes-Bergeronnes, 27-VI-1966 (1 female). Vaudreuil Co., Rigaud, 24 and 29-VIII-1969 (2 females). In Quebec, the long-winged forms are scarce, not geographically restricted, occur in both sexes and in populations with short-winged specimens.

* * *

NIDIFICATION AND REPRODUCTION OF *PHANAEUS* SPP. IN THREE TEXTURAL CLASSES OF SOIL (COLEOPTERA: SCARABAEIDAE)[1]

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Abstract

Nesting and reproduction of 3 species and 1 subspecies of *Phanaeus* were compared in 3 different textural classes of soil. *Phanaeus vindex* constructed brood balls in each of the soil classes but as the clay content of the soils increased, the number of brood balls constructed increased. The depth to the brood balls below the soil surface decreased as the content of clay in the soil increased. Survival of *P. vindex* to the third-stage larva was zero in the soil classed as sand, 50% in loamy sand and 95% in sandy clay loam. *Phanaeus torrens niger* constructed brood balls only in the sandy clay loam soil, whereas *P. igneus* and *P. igneus floridanus* failed to construct brood balls.

Introduction

Dung beetles of the genus *Phanaeus* in Georgia are important vectors of certain nematode parasites of swine (Porter, 1939; Stewart and Kent, 1963; Fincher, et al., 1969a). Three species and 3 subspecies of *Phanaeus* occur in Georgia. *Phanaeus vindex* MacLeay occurs throughout the state but is not as common in north Georgia as in middle and south Georgia. Only 2 specimens of *P. vindex cyanellus* Robinson have been captured, and these were from Tift County (Fincher, et al., 1969b). *Phanaeus torrens niger* D'Olsoufieff occurs in a small area located in the adjoining counties of Baker, Calhoun, and Dougherty (Fincher, et al., 1969b). *Phanaeus igneus* MacLeay is found throughout the lower half of the state below the Fall Line (roughly a line drawn through Columbus, Macon, and Augusta). *Phanaeus igneus nigrocyaneus* MacLeay has been seen only in a small sandy area of Tift County and on Blackbeard Island. *Phanaeus igneus floridanus* D'Olsoufieff is found in the southeastern counties of the state.

Members of the genus *Phanaeus* are the only dung beetles in the United States which form balls of feces underground and coat them with a thin layer of soil. The apparent protective nature of the outer hard shell suggests that soil type, distinguished primarily by texture, could be an important factor in the distribution of these beetles. Soil maps of Georgia indicate that *P. torrens niger, P. igneus nigrocyaneus* and *P. igneus floridanus* are limited in their distribution by soil type. Such is the case with the Jamaican species *Phanaeus carnifex* (Linnaeus), which is restricted to the red laterite or bauxitic soils of the island (Halffter and Matthews, 1966).

This report describes results of an experiment comparing nesting and reproduction behavior of 3 species and 1 subspecies of *Phanaeus* in 3 different textural classes of soil. The experiment was performed on a swine pasture of the Coastal Plain Experiment Station, Tifton, Georgia.

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[1] In Cooperation with the University of Georgia, College of Agriculture Experiment Stations, Coastal Plain Station, Tifton, Georgia 31794.

MATERIALS AND METHODS

Three 1.8 × 1.8 × 1.8 m pits were excavated and each was filled with either sand, loamy sand, or sandy clay loam soil. These soils were classed according to their texture as determined by a particle-size analysis revealing the percentages of sand, silt, and clay. The sand was purchased from a local construction company and consisted of 91.0% sand, 0.6% silt, and 8.4% clay. The loamy sand was obtained from a local housing contractor and was composed of 72.0% sand, 13.6% silt, and 14.4% clay. The sandy clay loam was the subsoil of the other 2 pits and contained 62.0% sand, 11.6% silt and 26.4% clay. Each test plot was partitioned into quadrates by thin sheets of steel which were attached to wooden boards and driven approximately 75 cm into the soil. The sides of the pits were lined with galvanized metal which also extended 75 cm into the soil. The top of the metal was attached to a square wooden frame lying flush with the soil surface.

Fifty pairs of *P. vindex* were placed in a quadrate of each soil class as were 25 pairs of *P. igneus* (Fig. 1). Six pairs of *P. igneus floridanus* were used in a quadrate of each soil class. Eight male and 12 female *P. torrens niger* were placed in a sandy clay loam quadrate, 4 males and 8 females were put in a loamy sand quadrate and 7 males and 6 females were placed in a sand quadrate. Additional beetles of the latter 2 species were not available at the beginning of the experiment. A screen top (5.5 squares per cm) placed 20 cm above the soil surface over the quadrates prevented the beetles from escaping.

Fresh swine feces were always available to the beetles in each quadrate until burial activity ceased. The beetles were placed in the quadrates during the week of 14-20 September 1969, and the test plots were dug the following February to depths of 2 m. Most larvae in the brood balls recovered from the test plots were reared to adults in an environmental chamber.

RESULTS

Twenty-three brood balls were recovered from the sand quadrate containing *P. vindex*. Their location below the soil surface ranged from 50 to 75 cm, averaging 60 cm. No live larvae were found in any of these brood balls, and larval remnants indicated that death occurred early in development. No brood balls were found in the quadrates of sand containing other species.

The loamy sand quadrate containing *P. vindex* yielded 56 brood balls. The location of these brood balls ranged from 25 to 60 cm below the soil surface, averaging about 40 cm deep. About one-half of these brood balls contained live larvae. Larval remains in the other brood balls indicated that most had died during the 3rd larval stage. No brood balls were found in the quadrates of loamy sand soil containing other species.

One hundred and fifteen brood balls were found in the sandy clay loam quadrate containing *P. vindex*. The brood balls were located from 5 to 40 cm below the soil surface, averaging 25 cm. One hundred and eight of these brood balls contained viable larvae. The quadrate containing *P. igneus floridanus* revealed 21 brood balls, but overwintered adult *P. vindex* were also found. The galvanized metal and sheet metal were not properly joined between the 2 quadrates, permitting *P. vindex* to enter the quadrate containing *P. igneus* *floridanus.* Adult *P. vindex* only were reared from the brood balls from this quadrate. The latter brood balls were found 15 to 35 cm below the surface.

The sandy clay loam quadrate containing *P. torrens niger* yielded 10 brood balls but only 4 contained live larvae and these were reared to adults in the laboratory. The *P. torrens niger* brood balls were constructed at about the same depth as those of *P. vindex.* No brood balls were found in the sandy clay loam quadrate containing *P. igneus.*

DISCUSSION

Of the 4 species, *P. vindex* was the only one able to construct brood balls in each of the 3 textural classes of soil. Such behavior parallels its wide distribution throughout the state in areas of widely differing soil types. Previous reports indicate that *P. vindex* brood balls occur at depths of 30 to 100 cm (Stewart and Davis, 1967) or in the first 10 to 15 cm of clay (subsoil) averaging 70 cm below the topsoil (Fincher, 1972). The present results however, showed that the average depth of the brood balls was less than 70 cm, even in the quadrate containing sand. Apparently the nearness of the subsoil to the surface was not the factor determining location of brood balls which would have been found at depths of at least 1.8 m in the sand and loamy sand plots of the present experiment. Therefore, *P. vindex* must rely on factors other than the depth to the subsoil below the soil surface for locating the brood chamber. Soil temperature and moisture content of the soil may be determining factors. However, crowding or other factors limiting the normal food finding and nidification behavior of the beetles in the present study must be considered in determining a "normal" depth for brood ball construction. The location of *P. vindex* brood balls in the same soil types under natural conditions may be quite different.

Dessication appears to be a major limiting factor in the reproduction of *P. vindex.* Twenty-three brood balls were constructed in the sand plot but no progeny survived. The brood balls were very dry and brittle when handled. Soils containing large amounts of sand are too permeable to retain large amounts of water. The moisture fluctuates greatly because large voids occur between adjacent soil particles. Dehydration during a drought period probably caused the death of the larvae in the brood balls coated with sand. Although *P. vindex* is found in sandy areas of the state such as the coastal counties, the population is not as great as that in inland counties with soils containing less sand. The high water table in the coastal counties provides moisture for the sandy soils throughout the year which may account for the survival of *P. vindex* in these areas.

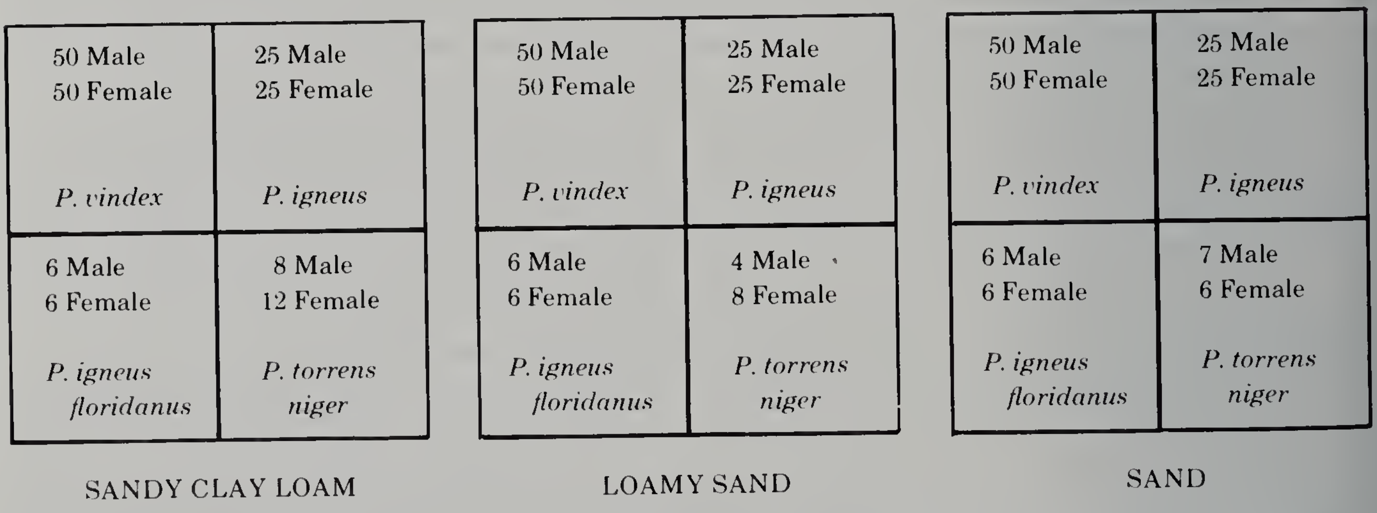
The lack of nidification behavior of *P. igneus floridanus* in the quadrate containing sand is difficult to understand because they are found only in sandy areas of the state. This subspecies occurs in the Atlantic Coast Flatwoods which is in the southeastern portion of the state, roughly paralleling the coast and extending 80 to 140 km inland. The surface soils of this area range from sands to loams and that of the subsoils from sands to clays.

The results from quadrates of the remaining 2 soil textures indicate that the greater the content of silt and clay, the greater the chances of the larvae reaching the adult stage. The increase in clay content increased the water holding capacity of the soil and perhaps triggered *P. vindex* to construct more brood balls. One hundred thirty-six brood balls were constructed by *P. vindex* in the sandy clay loam quadrate which was more than double the number constructed in the loamy sand quadrate. Also, 56 *P. vindex* brood balls were found in the loamy sand quadrate compared to 23 in the sand quadrate. The number of beetles were the same in each quadrate but the relative survival of adult beetles is unknown. Survival to the third-stage larva in the brood balls from the sandy clay loam plot was 95% compared to 50% in the loamy sand and zero in the sand plot.

The sandy clay loam contained the greatest percentage of clay and instigated the greatest production of brood balls by *P. vindex*. Although *P. vindex* constructed brood balls at an average of only 25 cm below the soil surface, 95% of them contained live larvae. Most Georgia soils have varying depths of topsoil containing less clay than the subsoil directly beneath. The depth of the topsoil, according to its physical characteristics, may determine the depth of brood ball construction.

The nidification behavior of *P. torrens niger* was as expected. Brood balls were constructed only in the quadrate containing the sandy clay loam because this species occurs in an area with little or no topsoil. The clay content of the scant topsoil ranges from 20 to 35% and that of the subsoil is above 37%.

Three environmental factors appear to be interrelated in influencing the production of brood balls and survival of larvae. Soil permeability decreases with an increase in clay content, fostering a decrease in moisture and temperature fluctuation. The soil usually dries from the surface downward. Normally, there is an increase in water content as the depth of the soil increases. The increase in water content increases soil density and the thermal capacity by volume. The thermal conductivity of wet sand and clay are similar; however, the range of thermal conductivity for dry sand is narrow when compared to that of dry clay which is relatively broad (Geiger, 1965). Furthermore, stabilization of soil temperature occurs with increased soil depth regardless of soil texture. Greater temperature fluctuations occur at ground level than at points a few centimeters below the soil surface. Geiger (1965) stated that temperature fluctuations on an undisturbed summer day in Leipzig, Germany, ranged from 14 to 40°C at the soil surface, but, at a depth of 35 cm, the temperature range was only 16 to 17°C. A much more elaborate experiment than the present one would be required to generate sufficient data to detect the role played by each of these factors and to estimate the effects of other factors.



50 Male 50 Female *P. vindex*	25 Male 25 Female *P. igneus*
6 Male 6 Female *P. igneus floridanus*	8 Male 12 Female *P. torrens niger*

SANDY CLAY LOAM

50 Male 50 Female *P. vindex*	25 Male 25 Female *P. igneus*
6 Male 6 Female *P. igneus floridanus*	4 Male 8 Female *P. torrens niger*

LOAMY SAND

50 Male 50 Female *P. vindex*	25 Male 25 Female *P. igneus*
6 Male 6 Female *P. igneus floridanus*	7 Male 6 Female *P. torrens niger*

SAND

Fig. 1: Arrangement of the Test Plots (number and species of beetles indicated in each quadrate).

CONCLUSIONS

Soil type, distinguished primarily by texture, is an important factor governing the distribution of the dung-burying *Phanaeus,* although only 2 of the observed species formed brood balls. The brood balls of *P. igneus* and its subspecies were not observed, and it is assumed that conditions necessary for nidification behavior were not met. Behavioral differences between *P. vindex* and *P. igneus* have been previously noted (Stewart, 1967; Fincher, et al., 1971). The interspecific differences apparently are much more complex than can be assumed by external morphological similarities.

ACKNOWLEDGMENTS

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BOOK NOTICE: *Insects of the World,* by Walter Linsenmaier. (Translated from the German by L. E. Chadwick) 1972. McGraw-Hill Book Co., 1221 Avenue of the Americas, New York, N. Y. 10020. 8½ × 11", 392p., thousands of illustrations; cloth, $25.00.

Wow! The only brief word I can think of to convey the awe experienced at such gorgeous and meticulous color paintings. If there is a better illustrator anywhere, I have not seen his work. The book is an absolute must for every entomologist (professional or amateur) and anyone else who admires the beauty of the world of insects or the beautiful technique by which it is artistically rendered.—R. E. Woodruff

BOOK REVIEW

by JOHN R. DIBB

23 Gordon Rise, Mapperley, Nottingham, England NG3 5GB

Coleoptera, Passalidae: Morfologia y division en grandes grupos; generos Americanos by Pedro Reyes-Castillo. 1970. Folia Entomologica Mexicana 20-22:1-240; 3 Photos, 186 Fig.

Pedro Reyes-Castillo, member of the Department of Zoology in the National School of Biological Sciences, I.P.N., Mexico, has once again illustrated his dedication to the study of the family Passalidae, both as a biologist in the field and a taxonomist in the laboratory. His present monograph is eminently successful in modernizing and simplifying the classification of the whole family, and in completely revising it to the boundary of generic differentiation, so far as the American representation is concerned. The magnitude of this task can only be fully appreciated by making a close study of the monograph, which I have been privileged to do.

The death, in 1961, of my close friend and colleague Dr. W. D. Hincks, robbed the Passalidae of its most indefatigable worker upon its classification during the past half century. The Reyes' monograph calls for considerable revision of the Hincks-Dibb Coleopterorum Catalogus (Junk) of 1935 and 1958, due to the newly erected basic classification. This demands but 2 subfamily divisions viz. Aulacocyclinae and Passalinae, in place of the former 7 subfamilies. In turn, the provision now made of most valuable comparative morphological studies from a large number of specimens of the American species (together with the clearing up of much former misusage of convergent characters) has resulted in extensive alterations in synonymy. With regard to tribal divisions, the major revision of the Proculini with its new diagnostic table, is of special importance owing to the need, now demonstrated, to break up the genera *Popilius* and *Proculejus,* to accommodate the appropriate species within the revised generic characterization which, in turn, has called for the creation of additional genera.

The work has been divided into 2 sections. 1) Estudio Morfologico y Valoracion Taxonomico de los Distintos Caracteres—the comparative morphological studies; and 2) Parte Sistematica, comprises the characterization of the family, subfamilies and tribes, followed by a detailed revision of the New World genera. Both sections are expertly illustrated wherever the text demands such additional clarification. The morphological studies include description of form, color and size, together with the necessary descriptive detail of the principal external structures. Nor have the internal structures, usable for differentiation purposes, been neglected.

The systematic section is especially comprehensive, and references to the known fossils are given. The new taxonomy of subfamilies, tribes and genera, is a model of clarity, and one new species is described. Type species are indicated; the species content of the genera are listed; synonymy is brought up to date, the generic affinities are mentioned; all the materials studied are diagnosed and commented upon, and the geographical distribution, limiting factors, and ecological associations are discussed. An extensive bibliography is included.

In conclusion, it is not possible to over-estimate the value of this carefully worked out expansive sectional revision of one of the most interesting families of Coleoptera. Pedro Reyes-Castillo has strikingly succeeded in significantly advancing our knowledge of the Passalidae.

A NEW SPECIES OF *COLAULON* ARNETT FROM TEXAS (COLEOPTERA: ELATERIDAE)

Josef N. Knull

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Abstract

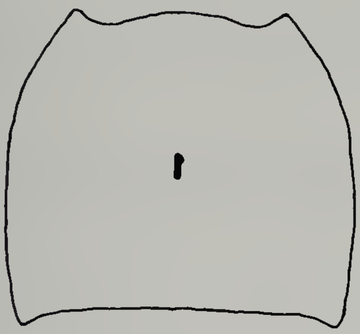
A new species of *Colaulon* is described from Texas Sand Hills.

Colaulon triplehornorum Knull, New Species.

Type Male: robust, convex; deeply, densely punctured on both surfaces, punctures of dorsal surface larger than those on ventral surface; color light brown throughout.

Head with front flat, a raised area at insertion of antenna, clypeus truncate; densely deeply punctured, a recumbent white scale arising from each puncture; antenna short, reaching to about middle of pronotum, scape stout, second and third segments short, subequal in length, fourth to tenth segments transverse, wider than long, eleventh segment oval.

Pronotum slightly wider than long, widest about middle; anterior margin sinuate, median lobe broadly rounded; basal margin truncate; basal angles obtuse, lateral margin finely serrate; disk convex, a broad depression each side at base; surface densely, deeply punctured, punctures separated by less than their diameters, a small recumbent white scale arising from each puncture, a narrow denuded area in middle extending from near base to past middle. *Scutellum* heart-shaped, densely punctured, a recumbent scale arising from each puncture.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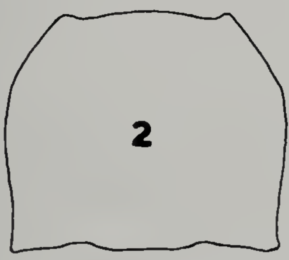
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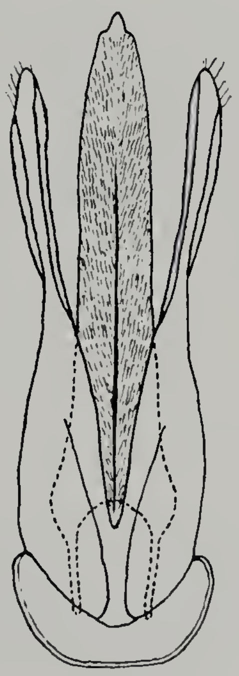
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Fig. 1,3: *Colaulon triplehornorum* new species: 1) pronotum, 3) male genitalia (length 1.6mm).

Fig. 2: *Colaulon rectangularis* (Say), pronotum.

Elytra at base slightly narrower than base of pronotum, widest in front of middle, sides expanded in front of middle, then broadly converging to apices; disk convex, depressed at base; surface with rows of deep coarse punctures separated by alternate narrow and wide interspaces which are clothed with recumbent white scales arising from minute punctures, the narrow interspaces have 2 rows of scales and the wider interspaces have more irregularly placed scales. This gives the appearance of striae to the naked eye.

Beneath densely, coarsely punctured, a recumbent white scale arising from each puncture. Prosternum very convex, prosternal lobe declivous, broadly rounded, antennal grooves deep, extending to over half the length of prosternal suture, tarsal grooves lightly indicated on propleura. Abdomen convex, last sternite broadly rounded at apex. Legs finely punctured, a small recumbent scale arising from each puncture; tarsi pubescent.

Length 9.5 mm.; width 3.6 mm.

ALLOTYPE FEMALE: Outer antennal segments less transverse.

Type male, allotype and 13 paratypes collected on the sand dunes in Monahans Sand Hills State Park, Ward Co., Texas, 16-VII-1972, Wanda E., Bruce W., and Charles A. Triplehorn for whom I take pleasure in naming this species. Six other paratypes are from the same locality dated 8-VII-1968 by the same collectors. Dr. Triplehorn informed me that the specimens were collected on the surface of the sand after dark. None of the beetles came to blacklight.

Type, allotype and paratypes in the Ohio State University Collection of Insects and Spiders, paratypes in collection of the author.

VARIATIONS: There is some variation in size of specimens from 9.3 × 3.6 to 11 × 3.8 mm. The background varies in color from light brown to dark brown.

This species is similar to *Colaulon rectangularis* (Say, 1825). It may be separated by the shape of the pronotum (Fig. 1). Also, the rows of elytral punctures in the new species are separated by alternate wide and narrow interspaces where in *rectangularis* the intervals are uniform in width.

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NEW ENTOMOLOGICAL JOURNAL: *Insect World Digest,* edited & published by Ross H. Arnett, Jr. R.R. #1, Box 161, Tallahassee, FL 32303. Bimonthly, $10.00/yr. ($8.50 if paid in advance).

Many of our readers are aware that Dr. Arnett has been working toward this new journal for some time. The first issue is "hot off the press" (Jan./Feb. 1973) and really looks great, from the color cover of a meloid (*Pyrota postica*) and the quality articles by Howard Evans and Philip Corbet, to the many original features. A subscription now will encourage the new magazine and help insure its high quality.—R. E. Woodruff

ADDITIONAL LECTOTYPE DESIGNATIONS IN THE APHODIINAE. (COLEOPTERA: SCARABAEIDAE)

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Abstract

Lectotypes are designated and label data are recorded for 30 species of Aphodiinae in the following museums: Museum National d'Histoire Naturelle (Paris), Staatliches Museum für Tierkunde (Dresden, DDR), Museum für Naturkunde (Berlin, DDR), Deutsches Entomologisches Institut (Berlin, DDR).

In 1964 I selected and published a list of lectotypes in the aphodiine genus *Ataenius*. In the present publication additional lectotypes in the Aphodiinae are selected, and label data are recorded. Included are the Harold species which I indicated in the previous paper I thought should be considered lectotypes even though the label data were incomplete. Appropriate labels have been attached. In addition the location of several previously unlabeled holotypes is given and the specimens have been labeled as holotypes. My notations are in brackets. The / mark separates data on individual labels. Spelling is that found on the labels.

Specimens in the Museum National d'Histoire Naturelle (Paris, France)

LECTOTYPES

Ataenius integer Harold, 1868:86. 3 labels: integer Harold/Brasilia/ Ex Musaeo E. Harold/.

Ataenius opatrinus Harold, 1867:82. 2 labels: Bahia. A. opatrinus talpa Reich. Har/ Ex Musaeo E. Harold/.

Ataenius picinus Harold, 1867:291. 2 labels: Chili Ataenius picinus mihi/ Ex Musaeo E. Harold/.

Ataenius opacus Harold, 1867:100. 3 labels: a small yellow triangle with line on one side and dot in middle/ opacus mihi type/ Ex Musaeo E. Harold/.

Ataenius figurator Harold, 1874:24. 2 labels: Louisiana/ Ex Musaeo E. Harold/.

Ataenius horni Harold, 1874:19. 2 labels: S. Carolina A. horni Type Harold/ Ex Musaeo E. Harold/.

Ataenius simulator Harold, 1868:85. 2 labels: Ataenius simulator Harold/ Ex Musaeo E. Harold/.

Ataenius sculptor Harold, 1868:85. 2 labels: sculptor/ Ex Musaeo E. Harold/.

Ataenius perforatus Harold, 1867:83. 2 labels: Ataenius perforatus Harold/ Ex Musaeo E. Harold/.

Ataenius scutellaris Harold, 1867:82. 2 labels: Caracas Ataenius scutellaris type Harold/ Ex Musaeo E. Harold/.

Ataenius capitosus Harold, 1867:83. 3 labels: Bogota/ capitosus Harold Kirsch/ Ex Musaeo E. Harold/.

Ataenius laborator Harold, 1869:102. 3 labels: Montevid. (verviens)/ laborator/ Ex Musaeo E. Harold/.

Ataenius punctipennis Harold, 1868:86. 2 labels: punctipennis type Harold/ Ex Musaeo E. Harold/.

Ataenius columbicus Harold, 1880:39. 3 labels: Columbia/ columbicus mihi/ Ex Musaeo E. Harold/.

Aphodius columbicus Harold, 1880:36. 3 labels: Viani/ Aphodius columbicus Typ. Harold/ Ex Musaeo E. Harold/.

Ataenius elegans Harold, 1868:85. 3 labels: Brasil elegans Typ./ brasiliensis Reiche Payet/ Ex Musaeo E. Harold/.

Ataenius complicatus Harold, 1869:102. 4 labels: Brasilia/ Ataenius melaneria Dj./ complicatus t. Harold/ Ex Musaeo E. Harold/.

Ataenius morator Harold, 1869:103. 4 labels: Bahia/ A. punctatipinis type mihi/ morator/ Ex Musaeo E. Harold/.

Ataenius sordidus Harold, 1869:103. 3 labels: Macejo (Bras.)/ sordidus Harold/ Ex Musaeo E. Harold/.

Ataenius attenuator Harold, 1874:22. 3 labels: attenuator typ. Harold/ abditus Haldm. [This in pencil on poor paper]/ Ex Musaeo E. Harold/.

Ataenius arenosus Harold, 1868:86. 2 labels: Ataenius arenosus Harold/ Ex Musaeo E. Harold/.

Ataenius peregrinator Harold, 1877:96. 3 labels: Celebes macassar I 74 0. Beccari/ Ataenius peregrinator Harold/ Ex Musaeo E. Harold/.

Ataenius aequalis Harold, 1880:40. 4 labels: small blue circle/ Ambalema/ aequalis Harold/ Ex Musaeo E. Harold/.

Euparia attenuata Harold, 1870:28. 3 labels: Brasilia/attenuata typ. Harold/ Ex Musaeo E. Harold/.

HOLOTYPE

Ataenius steinheili Harold, 1874:18. 3 labels: small blue circle/ Baranquilla Mompox/ Ex Musaeo E. Steinheil/.

SPECIMENS IN STAATLICHES MUSEUM FÜR TIERKUNDE (DRESDEN, DEUTSCHE DEMOKRATISCHE REPUBLIK):

HOLOTYPE

Auperia rhyticephalus Chevrolat, 1864:413. 6 labels: N. Amerika/ Coll. C. Felsche Kauf 20, 1918/ Staatl. Museum für Tierkunde Dresden/ rhyticephalus TYPUS Chev./ Auperia rhyticephalus Chev. an 1864 No 307-224 In'l Cuba. hana [probably an abbreviation of Havana] D. F. Poëy/ Ataenius rhyticephalus Chev. Amer. bor./.

LECTOTYPES

Auperia denominatus Chevrolat, 1864:413. 5 labels: Cuba/ Coll. C. Felsche Kauf 20, 1918/ Cuba Poëy/ Staatl. Museum für Tierkunde Dresden/ denominatus Chevr. stercoraria L Laval K 118 Inl Cuba havana D. Poëy 449/.

Auperia terminalis Chevrolat, 1864:414. 4 labels: Cuba/ Coll. C. Felsche Kauf 20, 1918/ Staatl. Museum für Tierkunde Dresden/ terminalis Dejean Inl Cuba Havana D. F. Poëy/.

Auperia sulcatulus Chevrolat, 1864:413. 5 labels: Cuba/ Coll. C. Felsche Kauf 20, 1918/ Colocephalus oh Cuba/ Staatl. Museum für Tierkunde, Dresden/ Sulcatulus (Reiche) Chvtan 1864-308 Ins Cuba Havana DFPoëy 224/.

SPECIMENS IN GERMAR COLLECTION, MUSEUM FÜR NATURKUNDE (BERLIN, DEUTSCHE DEMOKRATISCHE REPUBLIK):

HOLOTYPE:

Ataenius lecontei Harold, 1874:20. 3 labels: Carolina Zimm/ 26121/ A. Schmidt det/.

SPECIMENS IN DEUTSCHES ENTOMOLOGISCHES INSTITUT, BERLIN, DEUTSCHE DEMOKRATISCHE REPUBLIK.

LECTOTYPES:

Ataenius frankenbergeri Balthasar, 1938:56. Three specimens on same pin. Top specimen selected as Lectotype. 4 labels: W. H. Hoffman Havana 192/ Typus/ Ataenius frankenbergeri m. n. sp. Dr. V. Balthasar det/ Dtsch. Entomol. Institut Berlin/.

Ataenius havanensis Balthasar, 1938:56. 3 specimens on cards on same pin. Top specimen selected as Lectotype. 5 labels: 7.XI/ W. H. Hoffmann Havana 1921/ Typus/ Ataenius havanensis m. n.sp. Dr. V. Balthasar det./ Dtsche. Entomol. Institut Berlin/.

Ataenius sumatrensis Balthasar, 1941:184. 5 labels: Maryland V. 1925/ Sumatra leg et det. Fulmek/ Typus/ Ataenius sumatrensis n. sp. Typus Dr. V. Balthasar det./ Deutsch. Entomol. Institut Berlin/.

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CNEMAPLATIA SERICEA, A NATIVE BEETLE OF THE WESTERN U. S., RECORDED AS A PEST OF LETTUCE SEED (COLEOPTERA:TENEBRIONIDAE)

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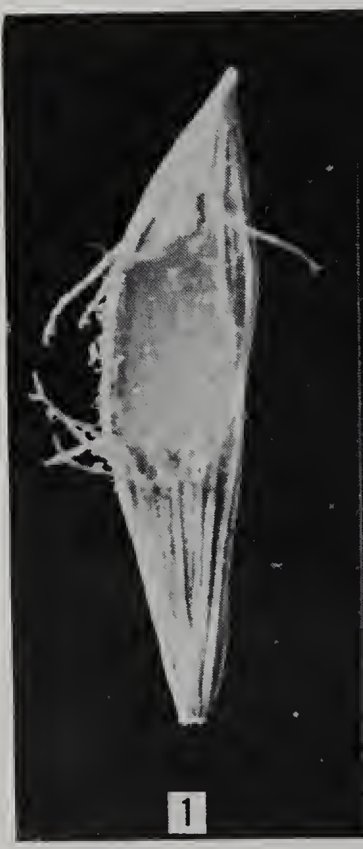
California Dept. Agr., 1220 N. St., Sacramento, CA 95814

The tenebrionid beetle *Cnemaplatia sericea* Horn is a common and widely distributed beetle of the lower elevations of California, Arizona, Nevada, Oregon, and Washington. It has been recorded as a nuisance pest in houses in California and Washington, but has not previously been shown to be a pest of agricultural crops. It was recently found infesting lettuce seed in large numbers near Five Points, Fresno Co., California. The beetle is normally quite common in sandy soil along river levees and irrigated fields and, in the late summer, it can be found in great numbers in light traps and at electric lights throughout the San Joaquin Valley.

Typical damage to the seed can be seen in Fig. 1 & 2. The seed in Fig. 1 is partially consumed, and that in Fig. 2 is totally consumed. Feeding involves a striping away of the pericarp and consumption of the endocarp as shown in Fig. 3, where an adult beetle can be seen feeding on a partially consumed seed.

The infestation was not noted until after seed had been transported to warehouses for processing. The harvest presently is composed of both seed and chaff, and, in the samples seen, beetles numbered in thousands per square foot. Lettuce seed at harvest is cut and spread on ground tarps adjacent to the fields, where it is left from 5 to 10 days for drying. It is then moved to the warehouse. It is likely that beetles entered the seed while they were on the tarps.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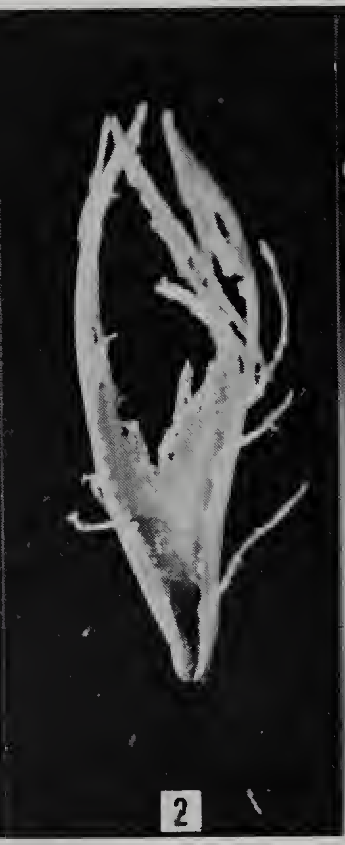
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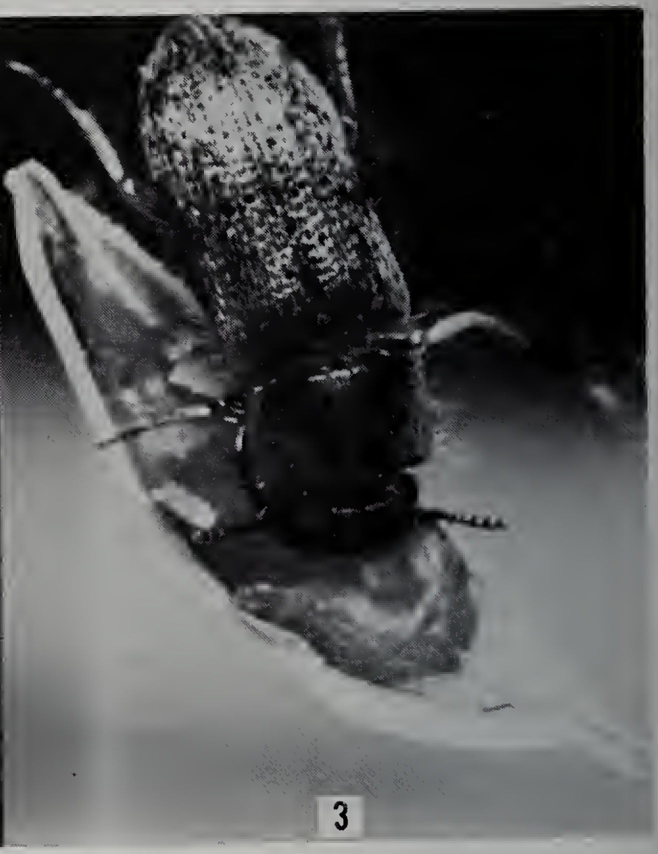
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PROGRESSION NORTH OF TWO SPECIES OF ROVE BEETLES IN CALIFORNIA (COLEOPTERA: STAPHYLINIDAE)

IAN MOORE AND E. F. LEGNER[1]

Division of Biological Control,
Citrus Research Center and Agricultural Experiment Station,
University of California, Riverside

In 1901, Henry Clinton Fall published his well known list of the beetles of southern California. Among the 2197 species were certainly included all of the common species not only from that region but from the state as a whole. Fall gave the extent of range of all of the species known to him. *Platystethus spiculus* Erichson was not included in the list. Of *Philonthus alumnus* Erichson, Fall stated, "the form with the red thorax and elytra is very common at Yuma on the river shore."

Platystethus spiculus was originally described from Venezuela and first reported in the United States from Texas by Casey (1886). It was first reported from San Diego County, California by Moore (1937) and later was found in most of the counties of southern California (Legner and Olton, 1970). Moore and Legner (1971) reported it from as far north as Stanislaus County in central California where the species is now common.

Philonthus alumnus was described from Puerto Rico and has been known for nearly a century from Mexico and most of the southern half of the United States. Horn (1884) reported it from as far west as Arizona. Specimens in the collection of the University of California at Riverside are from most of the desert counties of southern California, western Riverside County (San Jacinto, 1958), Kern County (1958) and from Sutter and Butte Counties in the Sacramento Valley (1968). All 3 color phases listed by Horn (1884:199) are among the California material.

Platystethus spiculus is synanthropic in California, being found most abundantly in accumulated manure in such places as dairies rather than in isolated field droppings. It could be speculated that it has spread because of the increase in its available habitat due to population rise in California and consequent proliferation of dairies. However, this is probably not the case. In Fall's time horses were the main mode of transportation and stables were found almost everywhere. Fall mentioned many species of Staphylinidae being found particularly in manure around stables which would have provided a very suitable habitat for this species.

Philonthus alumnus is found under cover near water and is attracted in large numbers to lights. It should have been found throughout its present range at the turn of the century if conditions had been suitable for it. It seems most likely that a gradual progressive increase in average temperature has made it possible for these species to extend their range through southern California and northward into the central valleys of California.

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[1] Staff Research Associate and Associate Professor of Biological Control, respectively, Department of Entomology, University of California, Riverside 92502.

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A SECOND CORRECTION TO THE KEY TO THE SUBFAMILIES OF THE NEARCTIC STAPHYLINIDAE

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In my key to the subfamilies of the Nearctic Staphylinidae (Moore 1964) an exception was found which required a restatement of couplet 12 (Moore 1967). Another exception has been found which can be corrected by inserting an additional couplet after couplet 13. The exception involves the genus *Conosomus* in the subfamily Tachyporinae. Couplet 13 separates 2 subfamilies whose members lack abdominal paratergites from 15 other subfamilies, including Tachyporinae, which key out as having paratergites. Members of the genus *Conosomus* lack paratergites and so would erroneously be keyed to the wrong part of the couplet. This may most easily be corrected by inserting an additional couplet (13a) after couplet 13 as follows:

13.	Abdomen without paratergites	13a
	Abdomen with paratergites	15
13a.	Hypomera not visible from the side	*Conosomus* (Tachyporinae)
	Hypomera visible, at least in part, from the side	14

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A NEW SPECIES OF *SCAPHINOTUS* FROM THE OLYMPIC PENINSULA (COLEOPTERA: CARABIDAE)

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ABSTRACT

A new species of *Scaphinotus* is described, illustrated, and compared with *S. angusticollis olympiae* (Van Dyke). The type locality is Klahowya, along the Soleduck River near Sappho, Clallam Co., Washington. The subgenus *Stenocantharis* is combined with *Brennus*.

In a preceding note (Perrault, 1972) on some interesting records of Carabidae from the Olympic Peninsula, I did not write about a particular locality pending completion of the morphological work on *Scaphinotus* specimens found there. Indeed the most interesting specimens I collected in the Olympic Peninsula in 1967-68 were a series of *Scaphinotus* found in dense humid rain forest under rotten logs on the ground covered with mosses and in very shady places, along the Soleduck river at the location called Klahowya near Sappho in the NW part of the peninsula. Other species collected at this locality were *Nomius pygmaeus* (Dej.), *Pterostichus herculaneus* (Mann.), *P. amethystinus* (Mann.), *P. algidus* (LeC.), *P. crenicollis* (LeC.), *Harpalus cordifer* (Notm.), and *Agonum ovipenne* (Mann.).

The specimens of *Scaphinotus* collected belong to 2 different species. One of these (8 specimens) was *Scaphinotus* (*Stenocantharis*) *angusticollis olympiae* (V.D.). The other (4 specimens) was believed at first to be *Scaphinotus johnsoni* (V.D.), but further studies showed that there were strong differences between the description of *S. johnsoni* and the specimens at hand. The elytral sculpture was described by Lindroth (1961), and Gidaspow (1968) as similar to that of *S.a.olympiae*, the main differentiating feature being the length of the labrum.

To the contrary, my specimens have very distinct, fine and regular striae though not so regular on the side of the elytra. All the caracters show that the specimens belong to subgenus *Brennus* and by using Gidaspow's (1968) monograph of that group, it is possible to note other differences: shape of pronotum, prosternal process, and more particularly of the penis. I am therefore convinced that my specimens belong to a species not yet described, although closely related to *S. johnsoni*.

Scaphinotus klahowyae Perrault, NEW SPECIES

HOLOTYPE: one male from Klahowya, near Sappho (Clallam Co.), Olympic Peninsula (Washington), G. G. Perrault, Aug. 1967, [author's collection].

ALLOTYPE AND PARATYPES: 3 females from the same locality, 2 (including allotype) Aug. 1967; one Aug. 1968. [National Museum of Natural History. Washington, D.C.].

Length: 17mm; Black with metallic hue, blue black on head and pronotum, violet on elytra with bright blue green color in the marginal groove; dull from strong microsculpture which is isodiametric on head, made of transverse mesh on pronotum, and isodiametric almost granulate on elytra except in lateral grooves which are shining; labrum with long lobes, length equal to width; clypeus without lateral furrows but with a median longitudinal groove in anterior part, longer in the female; seta orbitalis present; frons transversly wrinkled, continuous with clypeus; genae widened laterally, notched near anterior margin of eye.

Pronotum (Fig. 1) maximum width twice width at base (1.7 in *S.a.olympiae* (Fig. 2)); one seta toward middle of lateral margin, but no seta toward hind angle; base straight, basal margin complete, basal transverse impression almost straight, lateral ones little impressed; lateral bead strong and lateral margin broadly reflexed in anterior half; anterior marginal bead strong and anterior transverse impression well developed; whole surface transversly wrinkled.

Elytra depressed with 18 fine, very distinct, punctate striae, the 19th stria irregular at the edge of the wide, irregularly sculptured, shining marginal groove, where umbilicate punctures lay in deep foveae; lateral margin reflexed, more strongly so near apex; base margined and narrow, shoulder angulate; only striae 1,5,7,8,9 reach base, the others interrupted before, particularly 2 and 3 (Fig. 3); apices attenuated but rounded at tip;

All appendages dark, antennae from segment 4 brownish and pubescent; tarsi with setae above; anterior tarsi of male narrowly dilated, 3 segments with papillae beneath.

Prosternal process rounded, unmargined, with shallow fovea in center (Fig. 4); pygidium with 1 seta each side in male, 2 in female.

Penis long and narrow (Fig. 5 & 6), dilated in apical half, parallel in basal half; ventral margin straight, apex bent ventrally, broadly rounded. The name is derived from the type locality.

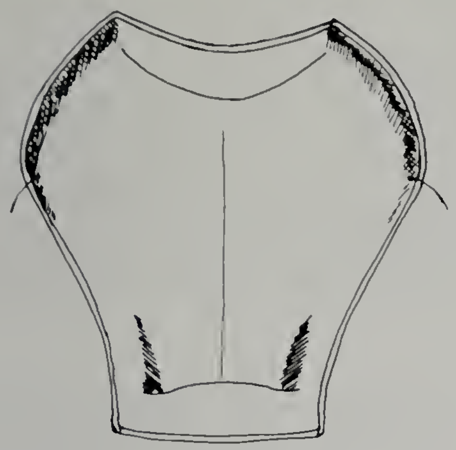
Discussion

The color is very similar to that of *S.a.olympiae* found in the same locality, but the shorter labrum, narrower pronotum, and shallow striae easily distinguish this species from *S. klahowyae.* With *S.a.olympiae* and *S.johnsoni* it appears that *S.klahowyae* will form a group of related species in the Olympic Peninsula that could have evolved from the same stock. *S.klahowyae,* as well as *S.johnsoni* (Van Dyke-1944), will be a transitional form between the 2 subgenera *Stenocantharis* and *Brennus.* I believe that the differences given between those 2 subgenera, when compared with the similarity of the 3 species within the species group defined above, do not justify keeping them distinct. Thus the key of the subgenera of *Scaphinotus* by Ball (1960) must be modified as follows:

7. Anterior tarsi of male broadly dilated; range: SE Wash. NE Oreg.; rare .... *Pseudonomaretus manni* (Wick.)

7′. Anterior tarsi of male narrowly dilated; range: California to S. Alaska and Aleutian islands .... s.g. *Stenocantharis* (sensu novo)

As a consequence and considering *S.marginatus* (Fisher) we can distinguish the 4 species of the subgenus found in the Olympic Peninsula as follows:



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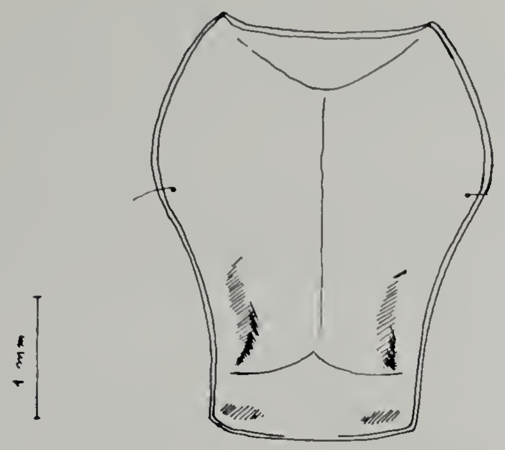

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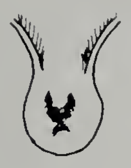

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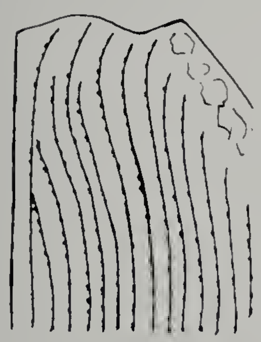

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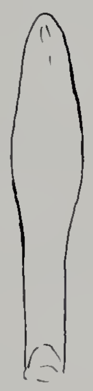

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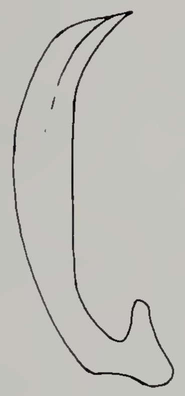

6.

Fig. 1,3-6: *Scaphinotus klahowyae* n.sp.: holotype: 1) pronotum, 3) base of right elytron, 4) prosternal process, 5) penis, dorsal view, 6) penis, left lateral view.

Fig. 2. *S. a. olympiae* (Van Dyke): pronotum of specimen from same locality.

1. Shining, less than 18 striae wavy on side, tending to form elongated tegulae .... *marginatus*
1′. Dull, heavily microsculptured, 18/20 striae .... *johnsoni* group........2
2(1′). Striae very distinct, fine and regular, easy to count .... *klahowyae*
2′. Striae shallow, difficult to count 3
3(2′). Ratio length/width of labrum about 0.6 .... *olympiae*
3′. Ratio length/width of labrum about 1.0 .... *johnsoni*

As another consequence, the key of Gidaspow (1968) must be modified for the introduction of *S.angusticollis* and *S.klahowyae*, and as there is some ambiguity in couplet °5 about the number of elytral striae, I suggest modifying it as follows:

STENOCANTHARIS (Gistl. 1858)

A Very long legged; anterior side of profemora without setae; soft hairs between the teeth of the lacinia of the maxilla long; 20 shallow striae; dull .... *angusticollis* (Mann.)
Short legged; anterior side of profemora with setae; soft hairs between the teeth of the lacinia of the maxilla short 1
5. More than 20 striae or lines of punctures, at least in apical half of elytron 6
20 or less striae 7
16. Seta orbitalis absent; anterior tarsi of male with papillae beneath on 2 segments only .... *striatopunctatus* (Chaudoir)
Seta orbitalis present; anterior tarsi of male with papillae beneath on 3 segments 17
17. Pronotum distinctly wider than long; elytral striae wavy on side, difficult to count .... *ventricosus* (Dejean)
Pronotum about as long as wide; elytral striae regular toward side, easy to count 18
18. Black, ventricose, shiny; pronotum parallel at base; 17/18 striae; south California .... *crenatus* (Mots.)
Dull black with metallic hue and elytral margin brightly metallic; 19 striae; Olympic Peninsula .... *klahowyae* n.sp.

I wish to thank Dr. G. E. Ball, University of Alberta, for very helpful discussions and for reviewing the manuscript.

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* * *

BOOK NOTICE: *This living earth*, by David Cavagnaro. 1972. The American West, 599 College Ave., Palo Alto, CA 94306. 8½ × 11", 191p., 112 color photos; cloth, $17.50.

One of the finest collection of natural history photos I have seen, maintaining the high quality already established by American West. The author-photographer majored in entomology and this influence is obvious in the fine photos (for which both photographic & scientific data are provided). He was honored by one of our members who dedicated a new beetle to him (*Ataenius cavagnaroi* Cartwright) from the Galapagos.—R. E. Woodruff

A CORRECTION IN THE TAXONOMIC IDENTITY OF *PLATYPUS PARALLELUS* (FABRICIUS) (COLEOPTERA: PLATYPODIDAE)

Stephen L. Wood

Department of Zoology, Brigham Young University, Provo, Utah

Abstract

Following type examinations, *Platypus parallelus* (Fab.) is established as the correct name for the species previously going under the names *P. rugulosus* Chapuis and *P. linearis* Stephens (New Synonymy). This species is economically important in the tropical forests of Mexico, Central and South America, and Africa.

Following a year of study and collecting in northern South America, I was greatly puzzled by the extreme rarity of the species then known as *Platypus parallelus* (Fabricius) in that area. I was also aware that the type locality of this species was Essequibo, British Guiana. Since it was not logical for the only South American specimen of *Platypus* treated by Fabricius to be an exceedingly rare species near its type locality, particular attention was given to the unique female holotype of this species when an opportunity came for me to examine it. It is in relatively good, recognizable condition and, without any doubt whatsoever, it is a female of the species previously known as *Platypus rugulosus* Chapuis (1865), the type series of which I have seen. Schedl (1960) established the synonymy of *rugulosus* and *linearis* Stephens (1832) through comparisons made by R. T. Thompson (personal communication) at the British Museum (Natural History).

Since this species is of extreme economic importance in the tropical forests of Mexico, Central and South America, and Africa, under ordinary circumstances it would be advisable to conserve the younger name rather than upset current nomenclature. However, Stephens' name came into use less than 12 years ago and in some respects it has not yet fully replaced some of the 22 synonyms listed by Schedl (1960).

For one reason or another, Chapuis (1865) did not establish the identity of *parallelus* from its type, which is 4.0 mm in length, but apparently he attempted to identify it from the original description or from erroneously named specimens. Whatever the cause might have been, the name *parallelus* became associated with a larger, darker, more slender species.

Platypus parallelus (Fabricius)

Bostrichus parallelus Fabricius, 1801, Systema Eleutheratorum 2:384 (Holotype, female; Essequibo, British Guiana; Universitetets Zoologiske Museum, Copenhagen).

Platypus linearis Stephens, 1832, Illustrations of British Entomology. Mandibulata 5:419 (Holotype, male; Sydenham, England; British Mus. Nat. Hist.) (Reference not seen, cited by Schedl, 1960, Mém. Inst. Roy. Sci. Nat. Belgique, ser. 2, 62:64). New synonymy.

In order to remove all doubt from this new synonymy, at my request, F. G. Browne carefully examined the male holotype of *linearis* and compared it directly to the male holotype of *rugulosus*. Both specimens are in good condition, and without any doubt, represent the same species. I have collected this species on numerous occasions in Florida, Mexico, Central and South America and have positively associated the males and females on many occasions. My male homotypes of *rugulosus* and female homotypes of *parallelus* are definitely known to represent males and females of the same species. It is on this basis and on Mr. Browne's observations, that the above synonymy is proposed.

In resolving this problem the assistance of Mr. Browne, in whose taxonomic judgement I have complete confidence, is gratefully acknowledged.

Platypus bellus Schedl

Platypus bellus Schedl, 1933, Rev. d'Ent. 3: 172 (Holotype, male; San Ignacio, Alto Paraná, Argentina; presumably in the Schedl Coll.).

In view of the misidentification of the type of *Bostrichus parallelus* Fabricius, cited above, by Chapuis and subsequent workers, the species they referred to by this name must now become known by the name of the senior synonym, *Platypus bellus* Schedl. Since Schedl's type is not currently available for loan I could not confirm its identity and must refer to Schedl (1960:26).

REFERENCES CITED

CHAPUIS, F. 1865. Monographie des Platypides. Liége: Dessain. 344 p.; 202 Fig.

SCHEDL, K. E. 1960. Chapuis Platypodidae. Ein revision mit ergänzungen. Mem. Inst. Roy. Sci. Nat. Belgique, Ser. 2, 62:1-68.

* * *

LITHOCHARIS ARDENUS SANDERSON IN CALIFORNIA (COLEOPTERA:STAPHYLINIDAE)

IAN MOORE

Staff Research Associate, Division of Biological Control, Citrus Research Center and Agricultural Experiment Station, University of California, Riverside 92502.

Lithocharis ardenus was originally described (Sanderson, 1945, Proc. Ent. Soc. Washington 47:94-97) from New York to Georgia and as far west as Kansas. It was reported from grass cuttings and from lights. It has not been mentioned in the literature since its original description. There are in the collection of the University of California at Riverside, 12 male specimens taken at Orange, Orange County, California by E. F. Legner from accumulated poultry manure on various dates from August through November, 1968 and 1969. Another male is from Sacramento, Sacramento County, California, 12 November 1970, R. F. Wilkey.

* * *

(*continued from inside front cover*)

or counties listed. Dates are listed by day, month (in Roman numerals), and last 2 digits of the year. Listing of ecological data is encouraged. Location of specimens should be shown in brackets; if the data is extensive these should be abbreviated as shown and the abbreviations listed in the text.

Any article concerning Coleoptera will be considered. Descriptions of new taxa must contain keys (or be correlated with existing keys) and illustrations. All manuscripts should be typed on 8½x11" opaque white paper with 1 inch margins. They should be typed on one side only and double spaced throughout (including title, footnotes, tables, figure legends, and references). All scientific names should be underlined. Use the following order: title, author, author's address, abstract, body of text, references cited, and figures. All footnotes, tables, and figure legends should be provided on separate sheets and double spaced. Indicate approximate figure and table locations in pencil in the margin of the manuscript.

An abstract should be a concise statement of the facts presented, not *that* they are presented (e.g. list names of organisms, not just that they were discussed or described as new). These abstracts are the key to how your article will be cited in the abstracting journals and should be carefully written.

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HYDROPHILIDAE: Presently revising the genus *Hydrochus* from North, South, and Central America, including the Antilles. Request loan of any material from the Western Hemisphere. John L. Hellman, Ent. Dept., Univ. Maryland, College Park, MD 20742.

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SCARABAEIDAE: Wanted, various species of ***Megasoma,*** male and female, major and minor forms. Will exchange pairs of ***M. pachecoi.*** Terry W. Taylor, 8529 Norwood Place, Rosemead, CA 91770.

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SCARABAEIDAE: Working toward a world revision of the Anomalini. Specimens and records needed from all areas, by loan, purchase, or general exchange. Identifications by arrangement, correspondence invited. R.W.L. Potts, California Acad. Sci., Golden Gate Park, San Francisco, CA 94118.

COCCINELLIDAE: North American specimens and locality records of ***Coccinella undecimpunctata*** L. required for distribution study of this species. M. Y. Watson, Dept. Biology, Laurentian Univ., Sudbury, Ontario, Canada.

REPRINTS DESIRED: Now working on the interpretation and integration of available evidences on phylogeny in construction of a phylogenetic classification of Coleoptera. Reprints are requested from specialists in all families. Mohammad Abdullah, Zoologische Staatsammlung, 8 Munich 19, W. Germany.

CARABIDAE: Need material for study of New World ***Philochtus*** (Bembidiini) including ***Cyclolopha.*** G. G. Perrault. 138 Rue Houdan, 92, Sceaux, France.

LUCANIDAE: Buy, sell, exchange all species. Also wanted: collection data and World literature on the family. Chris Adamson, 2030 Bancroft Way No. No. 5, Berkeley, CA 94704.

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Manuscripts will be considered from any authors, although those from members of the Coleopterists Society will be given priority. It is suggested that all prospective authors join the Society. All manuscripts should conform to instructions in the **Style Manual for Biological Journals** (3rd Ed.) prepared by the Committee on Form and Style of the Conference of Biological Editors, and published by the American Institute of Biological Sciences, 2000 P Street NW, Washington, DC 20063.

The following exceptions are noted: 1) All geographical names are to be spelled out, 2) use words, not symbols, for male and female, 3) use numerals throughout, except to begin a sentence, 4) entomology, -ical, -ist, etc. are to be abbreviated Ent. in literature citations.

Specimen label data should be listed in the following manner: MEXICO: State of Veracruz, Fortin de las Flores, 10-VIII-70, I. B. Jones, under bark of **Pinus moctezumae,** 7000ft. [USNM] (2). The number in parentheses indicates the number of specimens. Geographical names are listed in order with largest units first, with states, departments, provinces, parishes, and/

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GENETIC BASIS FOR THE VARIETAL FORMS OF *PHYMATODES TESTACEUS* (LINNAEUS) (COLEOPTERA: CERAMBYCIDAE)

LESTER L. LAMPERT, JR.

17 Hillview Circle, Asheville, N. C. 28805.

ABSTRACT

In a single population of *P. testaceus*, composed of both the blue and brown varieties, the blue variety outnumbered the brown almost exactly 3 to 1. This suggests that the color variation is due to a single gene, dominant for blue and recessive for brown.

The type of the longhorn beetle, *Phymatodes testaceus* (Linnaeus), is an overall light brown in color. The one varietal form, *P. testaceus* Var. *variabilis*, while identical in size and shape, is strikingly different in color, having blue-black elytra (Knull, 1946 and Linsley, 1964). Hereafter the 2 varieties will be referred to as "brown" and "blue".

During late May through early June of the years 1969, 1970, and 1971 I observed the simultaneous emergence of both varieties from the bark of oak logs stored in my woodshed at Fletcher, North Carolina (altitude 2200 ft.). The logs were from a lightning-killed tree in my yard, and had been stored about 3 years.

Upon emergence, starting at dusk and continuing for several hours each night, the beetles immediately commenced mating upon the logs from which they had just issued. Coupling was indiscriminate both among and between varieties.

Over the 3 seasons I captured a series of 91 specimens (a good random cross section of the population), of which 67 were blue and 24 were brown. These figures approach very closely the simple Mendelian ratio of 3:1 to be expected from a cross of heterozygotes in which elytral color is controlled by a single gene dominant for blue and recessive for brown. This is affirmed by a chi-squared test which shows a probability of more than 75 percent that the hypothesis is correct.

If the hypothesis is indeed correct, we would expect to find homozygous local populations of 1 variety only, as well as heterozygous populations with various proportions of both varieties. I would be happy to hear from collectors who have had experience with populations of *P. testaceus* which bear upon this subject.

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FURTHER OBSERVATIONS ON PHLOEOSTICHIDAE AND CAVOGNATHIDAE, WITH DEFINITIONS OF NEW GENERA FROM AUSTRALIA AND NEW ZEALAND

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Introduction

The new families Phloeostichidae and Cavognathidae were defined by Sen Gupta and Crowson (1969) to include forms previously referred by them (1966) to Boganiidae. Later studies have produced no evidence in support of a direct affinity of either Phloeostichidae or Cavognathidae to Boganiidae, but have tended to indicate affinities of both families to Cryptophagidae and Cucujidae. In the present study a new genus is defined within each of the 2 families, 2 genera are transferred to Phloeostichidae, new larval types are described in both families, and further data on habits of Cavognathidae are adduced.

Family Phloeostichidae Sen Gupta & Crowson 1969

This group is less satisfactorily characterised, and includes more heterogeneous forms, than Cavognathidae; its definition and extent are somewhat broadened to include the genus *Priasilpha* Broun and a related genus from Tasmania defined below. A revised definition of the family follows:
HEAD with a constriction behind eyes leaving distinct temples, or apterous and with reduced eyes; fronto-clypeal suture rarely distinct; longitudinal grooves present behind maxillae, or apterous and with reduced eyes; mandibular cavities, if present, opening on dorsal surface; antennae 11-segmented with a weak 3-segmented club.
THORAX with front coxal cavities partially closed behind by hypomeral processes, with narrow to broad lateral extensions partly to wholly exposing trochantins. Mesepisterna without pockets at inner angles, middle coxal cavities widely open outwardly, trochantins exposed; elytra usually with rows of strial punctures, the suture, except in apterous forms, showing a distinct gap in its apical ¼. Meso-metasternal junction between coxae in a straight line or with a single metasternal knob; wings never with closed Radial or Anal cells, usually 5 Anal veins in main group. Legs with all trochanters short and normal, male tarsi heteromerous.
ABDOMEN with ventrite 1 lacking femoral lines and not much longer than 2; paratergites absent; aedeagus of cucujoid type with a single more or less broad median strut; ovipositor with all normal parts, proctiger, and paraprocts drawn out into distinct baculi.

If the family Phloeostichidae is not a very sharply defined group on adult characters, the task of defining it on larval characters is even more difficult in the present state of knowledge. To a great extent, such a definition is liable to be negative, based on the absence of special features of any other Clavicorn families. The larvae I have been able to study represent the genera *Priasilpha*, *Hymaea, Rhopalobrachium,* and *Agapytho* and, except for the absence of *Phloeostichus* itself, constitute a fairly representative sample. An old description of the *Phloeostichus* larva (Ganglbauer 1899:605) is quite inadequate for modern systematic purposes, but suggests something similar to *Hymaea* or *Agapytho.* Hymaeinae seem to be larvally distinguishable from most, if not all, other clavicornia by the fusion of the labrum to the clypeus without an evident suture, and Priasilphinae are similarly distinguishable by having the abdominal spiracles on long, branched, recurved, lateral processes; except for its greater number of ocelli, the *Agapytho* larva differs little from a basic Cryptophagidae type, or from some Languriidae or a supposed larva of *Ericmodes* (Protocucujidae).

It may well be that the subfamilies of Phloeostichidae would be better treated as independent families, with individual affinities to other clavicorn families. *Phloeostichus* has slight resemblances to Cucujidae proper (e.g., *Pediacus*), *Hymaea* to Hyliotinae (e.g., *Dendrophagus*), and *Agapytho* is somewhat cryptophagid-like. Until stronger phylogenetic evidences become available, it is perhaps more practically convenient to retain these forms in one family.

Revised Key to Subfamilies of Phloeostichidae

1. Meso- and metasterna meeting in a straight line between coxae; front trochantins almost entirely exposed; elytra with epipleura well defined nearly to apex; tarsal segment 1 distinctly shorter than 2; mandibles without cavities, aedeagus with distinct parameres .... 2.

1′. Metasternum with a well developed knob received in mesosternum; front trochantins partially hidden, lateral angular extension of front coxal cavities narrow; epipleura distinct only near base; tarsal segment 1 not shorter than 2; mandibles with dorsal cavities, or aedeagus without articulated parameres .... 3.

2(1). Species apterous, with reduced eyes (Fig. 1), head with post-ocular constriction indistinct or absent; prosternal process (Fig. 3) broader than long; tarsal segment 1 more than ½ as long as 2, 5 at least as long (Fig. 4) as previous 4 together; Australian and New Zealand species .... 1. PRIASILPHINAE

2′. Species winged, eyes well developed, head with well marked post-ocular constriction; prosternal process longer than wide; tarsal segment 1 not more than ½ length of 2, 5 shorter than 1-4 together; Holarctic species .... 2. PHLOEOSTICHINAE

3(1′). Mandibles with a well marked dorsal tubercle and cavity; aedeagus with articulated parameres; elytral punctures forming very distinct strial rows; side margins of prothorax more or less toothed; Australian and Chilean species .... 3. HYMAEINAE

3′. Mandibles without dorsal tubercles or cavities; aedeagus without parameres; elytral punctures not forming longitudinal rows; side margins of prothorax sinuate but not definitely toothed; New Zealand species .... 4. AGAPYTHINAE

Subfamily PRIASILPHINAE

In addition to the New Zealand genus *Priasilpha* Broun, this group as here characterised will include a related Tasmanian form, for which the new genus *Priastichus* is defined below. The 2 genera may be distinguished as follows:

1. Eyes almost round; prosternal process (Fig. 3) less than twice as wide as long; elytra with 4 raised longitudinal ridges each, epipleura marrow; abdomen with 2 basal ventrites connate, ventrites together longer than width of basal one; Tasmanian species .... *Priastichus* gen. nov.

1′. Eyes strongly transverse; prosternal process more than twice as wide as long; elytra without raised longitudinal ridges, epipleura very broad in basal 2/3; abdomen with all ventrites free, together not longer than width of basal one; New Zealand species .... *Priasilpha* Broun

PRIASILPHINAE

In addition the characters given in the key, Priasilphinae may be defined as follows:

HEAD with no trace of frontoclypeal suture, labrum very transverse, antennal insertions not covered by margins of frons, antennae rather slender with weak 3-segmented club, anterior gular region with some trace of longitudinal grooves, gular sutures somewhat convergent in front, tentorium of normal form with well developed laminatentorium, mandibles with 2 apical teeth, a rather large membranous setose prostheca and strongly developed mola, the latter with small asperities forming numerous transverse rows.

PROTHORAX transverse, with side margins sharp, somewhat angled or incised; hypomeral processes extending about 2/3 of way to meet prosternal process.

ELYTRA with side margins curved, a sharp basal margin as far as scutellum, sutural margins not divergent near apex, scutellum exposed, small, transverse; middle coxae separated by a distance at least equal to their longitudinal width.

METATHORAX with sternum short, very transverse, without median groove, hind coxae separated slightly more widely than middle ones; metendosternite with very short broad stalk, anterior tendons widely separated. Legs rather slender, femora little inflated in middle, all tibiae with 2 normal apical spurs.

ABDOMEN with tergites 1-6 pale and membranous, 7 sclerotized and pigmented, 8 hidden under 7; aedeagus with basal strut of median lobe very broad, ovipositor with all normal parts distinct, paraprocts and proctiger forming 2 pairs of well sclerotized short baculi (Fig. 5).

Priastichus Crowson, NEW GENUS

Type species, *P. tasmanicus* sp. nov.

In addition to the characters indicated in the subfamily definition and the key to genera, the genus may be defined as follows:

HEAD (Fig. 1) with small round lateral eyes, the capsule slightly contracted immediately behind them, without distinct temples; sides of front raised above antennal insertions, labrum somewhat deflexed, its front margin evenly rounded; anterior gular region with well marked longitudinal grooves behind maxillae (Fig. 1). Antennae rather slender, segments as figured (Fig. 2). Mandibles without cavities, single-toothed at apex, molar part with transverse ridges, prostheca represented by an obtuse setiferous protuberance in front of mola.

PROTHORAX with front margin scarcely narrower than hind margin, sides broadly explanate, broadest near middle, where they are distinctly incised (Fig. 3), strongly contracted to hind angles, hind margin not bordered.

Scutellum very transverse, almost rectangular.

Elytra with 4 more or less interrupted raised longitudinal ridges between suture and outer margin, the 1st and 4th joining just before apex, the 2nd ending just before this junction and the 3rd ending before the 2nd; punctures showing no indications of striae; outer margin only slightly curved in basal 2/3.

Metepisterna not covered by epipleura, punctured like metasternum.

Abdomen with ventrites 1-4 decreasing progressively in length, ovipositor as figured (Fig. 5), tergite 7 large and distinctly sclerotized, with spiracles in its edges.

Legs rather slender, femora almost parallel-sided, tibiae only slightly widened to apex.

Priastichus tasmanicus Crowson, New Species

General colour dark chestnut brown, derm shining and without evident micro-sculpture but more or less covered by a dull greyish waxy layer. Upper surface with rather short, sparse, stout, recurved setae.

HEAD with about 10 ommatidia along a meridional line of the eyes, vertex rather closely punctured with irregularly oriented kidney-shaped punctures, each bearing a short recurved seta, occiput with much finer punctures, their setae directed forwards. Side of front markedly raised above antennal insertions.

PROTHORAX shaped as figured (Fig. 3), side margin broadly explanate and somewhat raised, notum with broad shallow impressions by front and hind angles, its central part markedly convex, punctured as vertex of head, setae on disc mainly directed towards centre.

ELYTRA with punctures rather larger and more rounded than those of head and pronotum, moderately close, even and irregular, absent on the crests of the ridges; the longitudinal ridges all more or less interrupted, the innermost one with about 5 interruptions, the second with 5 interruptions, the 3rd with 3, the 4th distinct only in apical half where it is twice interrupted.

Overall length of holotype, 4.8 mm, maximum width of prothorax 2.4 mm, length of prothorax 1.3 mm, maximum width of elytra 2.8 mm.

Holotype female, Highland of Burnie, Tasmania, March 1957, P. J. Darlington; paratype female, dissected and mounted on slide, Ben Lomond, c. 5000 ft., Tasmania, March 1957, P. J. Darlington [Museum of Comparative Zoology, Harvard University, Cambridge, Mass. USA]

Subfamily HYMAEINAE Sen Gupta & Crowson 1969

As originally defined, this group included 2 genera, *Hymaea* Pascoe and *Rhopalobrachium* Bohemann. As a result of studies of the skeletal structures of *Anaplopus tuberculatus* Blackburn it is evident that it belongs in Hymaeinae rather than in Pedilidae to which it was originally attributed, or Tenebrionidae among which it was placed by Abdullah (1966); the inclusion of the additional genus does not involve any change in the definition of the group. The 3 genera may be distinguished as follows:

1. Species larger (length at least 15 mm), tibiae distinctly keeled along outer edge; head with well defined fronto-clypeal groove; middle coxae separated by a distance equal to their apparent width; Chilean species .... *Rhopalobrachium* Bohemann

1′. Species smaller (length not more than 10 mm); tibiae not keeled on outer edge; middle coxae separated by less than their apparent width; Australian species 2

2. Head with a transverse groove in front of frons; prothorax without distinct side margins; tarsi very slender; species larger .... *Anaplopus* Blackburn

2′. Head without a transverse groove between antennae; prothorax with side margins distinct, more or less toothed; tarsi less slender, species smaller .... *Hymaea* Pascoe

Family CAVOGNATHIDAE Sen Gupta & Crowson 1969

By the kindness of Dr. J. C. Watt, I have been able to study adults and larvae from New Zealand representing a new genus and species having all the characteristics of this family as previously defined.

Revised Key to Genera of Adult Cavognathidae

1. Apical margin of clypeus angularly emarginate. Mandibles with 2 cavities. Tarsal segments 2 and 3 slightly lobed below, 4 markedly smaller than 3. New Zealand species .... *Neocercus* Broun

1′. Apical margin of clypeus straight or curved. Mandibles (Fig. 6) each with a single cavity. Tarsi, at least in females, with segments 2 and 3 not distinctly lobed below, 4 scarcely smaller than 3 .... 2.

2. Front anteriorly with a deep transverse groove. Antennae thick, segments 4-8 transverse, about equal in length. Abdominal segments 2-6 with well defined paratergites. Head with post-ocular constriction immediately behind eyes, no distinct temples. Australian species .... *Cavognatha* Crowson

2′. Front anteriorly without transverse groove. Antennae thinner, segments 4-8 not transverse, alternately longer and shorter. Abdominal segments with paratergites absent or incompletely separated. Distinct temples present, post-ocular constriction not immediately behind eyes .... 3.

3. Front coxal cavities almost closed behind by epimeral processes (Fig. 8). Abdominal segments 2-6 with paratergites partly separated. Prothorax less narrowed in front of middle than behind it (Fig. 8). Ventrites 2-4 with characteristic oblique impressions near front angles (Fig. 9). New Zealand species .... *Zeonidicola* gen. nov.

3′. Front coxal cavities more widely open behind. Abdominal segments with no trace of paratergites. Prothorax at least as much narrowed in front of middle as behind it. Ventrites 2-4 without such marked impressions. Chilean and ?Australian species .... *Taphropiestes* Reitter

Zeonidicola Crowson, NEW GENUS

Type species *Z. dumbletoni* sp. nov.

In addition to the characters indicated in the key, the genus may be characterised as follows:

HEAD with front margin of clypeus emarginate, markedly raised above very short labrum; post-ocular constriction continued as a sharp dorsal line separating vertex from occiput. Antennal club very weak, segment 11 elongate (Fig. 7).

THORAX with prothorax distinctly angled at sides just in front of middle, very slightly contracted to front angles, more strongly so to hind angles (Fig. 8). Scutellum very transverse, rectangular with rounded hind angles. Elytra somewhat depressed immediately behind scutellum. Mesosternum with ridges delimiting an almost regular hexagonal central part in same plane as metasternum.

ABDOMEN with ventrites 2-5 with characteristic oblique impressions close to front angles (Fig. 9), retracted aedeagus turned on its R side, as figured (Fig. 10), with a single broad median strut.

Zeonidicola dumbletoni Crowson, NEW SPECIES

HEAD with vertex shining, rather diffusely punctured in middle, more closely towards front and side margins, setae recumbent, directed mainly backwards, longer than average distance between adjacent punctures; antennal segments as figured (Fig. 7).

THORAX with pronotum rather more strongly and closely punctured than vertex, interstices smooth and shining, a rather broad unpunctured median line in posterior two-thirds, setae recumbent, directed towards centre, those of side margins directed forwards. A shallow indistinct impression on either side of smooth median line in basal half. Scutellum finely punctured and pubescent.

Elytra rather more closely punctured than pronotum, its setae recumbent and directed backwards, interstices finely sculptured and slightly dull.

Overall length about 3.3 mm, maximum width of prothorax 0.65 mm., length of elytra 1.9 mm.

Holotype and 9 paratypes, plus 9 larvae, from nestlings of *Stictocarbo punctatus* (spotted shag, family Phalacrocoracidae).

The fact that adults of *Cavognatha pullivora* Crows. have been found only in nests, and larvae on nestlings, of *Gymnorhina tibicen,* while *Zeonidicola* has been found exclusively in a similar association with *Stictocarbo punctatus,* and that adult beetles found in the nests of *Smicrornis brevirostris* (Chisholm 1952) were identified by J. Balfour Browne as "*Taphropiestes* sp.", suggests strongly that birds' nests may be the general and ancestral habitat of Cavognathidae. The fact that the 3 bird species mentioned belong to widely different families with widely different nesting habits suggests in turn that the beetle-bird association in this case may be an old one, and that more species of Cavognathidae may remain to be discovered. If Cavognathidae are a "good"

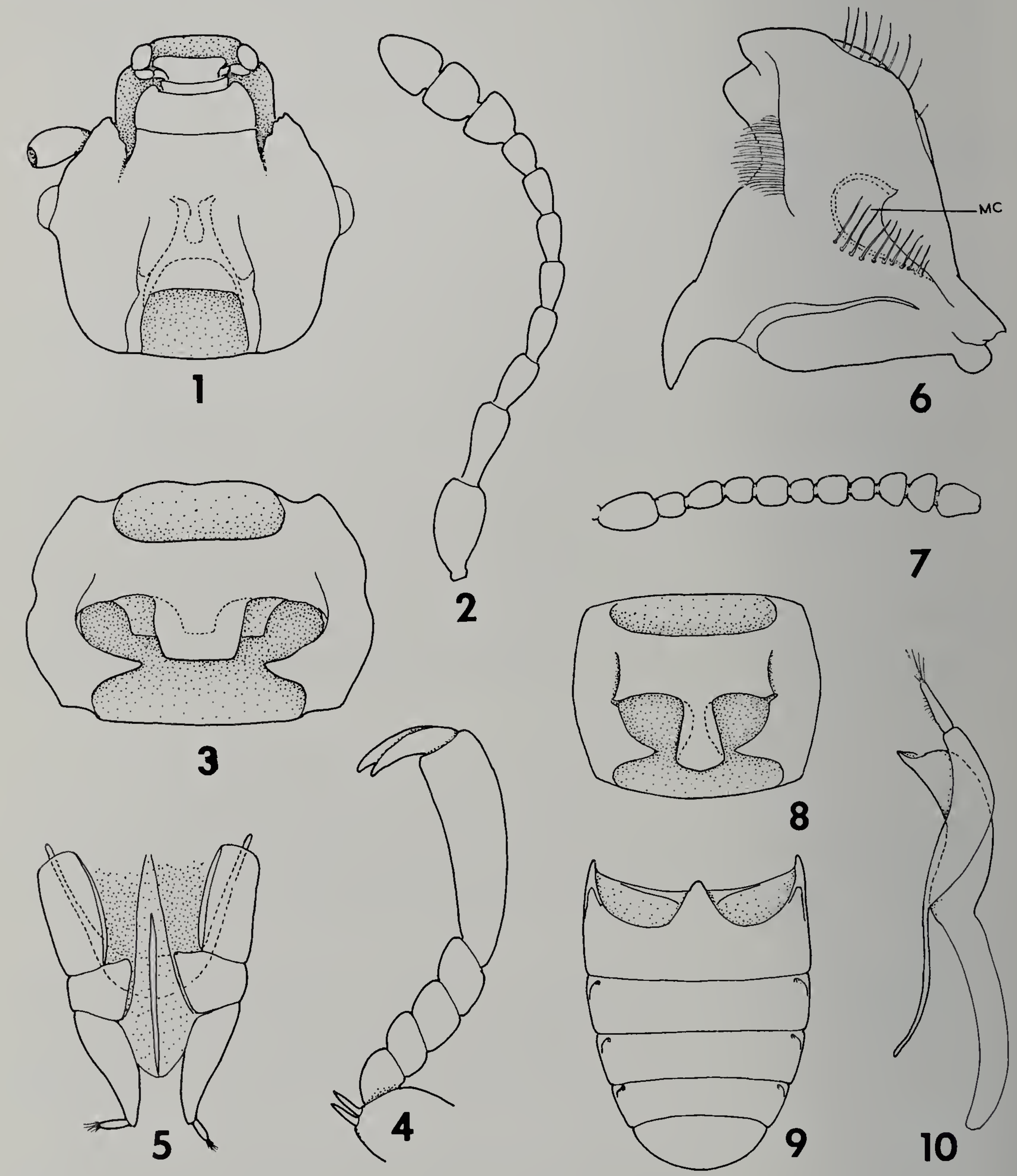

Fig. 1-5. *Priastichus tasmanicus*: 1) head, ventral view, mandibles and maxillae removed, 2) antenna, 3) prothorax, ventral view, legs removed, 4) tarsus, 5) ovipositor, ventral view.

Fig. 6-10. *Zeonidicola dumbletoni*: 6) R mandible, dorsal view, 7) antenna, 8) prothorax, ventral view, legs removed, 9) abdomen, ventral view, 10) aedeagus, lateral view.

family of Coleoptera, then their separate ancestry should go back into the Mesozoic period, and might well be about as old as that of Neornithan birds (first known as fossils from the Cretaceous period). If the closest existing relatives of Cavognathidae are Cryptophagidae, then it may be significant that quite a number of species of the latter family have been recorded from birds' nests (Hicks 1959).

The Positions of Phloeostichidae and Cavognathidae in Clavicornia

In the revision by Sen Gupta & Crowson (1966) of part of the key to families of Clavicornia of Crowson (1955), couplets 12 to 15 should be modified as follows:

12. Front coxal cavities broadly closed behind, with no trace of angular lateral extensions; tarsi not at all lobed below, segment 5 as long as 1-4 together, with a conspicuous empodium; head with subocular antennal grooves .... HELOTIDAE

--. If front coxal cavities broadly closed behind, tarsi more or less lobed below and with segment 5 much shorter than 1-4 together; head without subocular antennal grooves .... 13.

13. Elytral suture showing a distinct gape in apical ¼, or species apterous; head nearly always with longitudinal grooves behind maxillae; front coxal cavities open behind; retracted aedeagus never inverted, median lobe with a single broad median strut; wings with 5 Anal veins in main group, no closed Radial cell; tarsi 5-5-4 segmented in male, or mandibles with cavities opening on their outer edges; front coxae with trochantins partially to completely exposed .... 14.

--. Elytral suture without a gape, species rarely apterous; head rarely with longitudinal grooves behind maxillae; front coxal cavities often closed behind; retracted aedeagus often inverted, median lobe never with a broad median strut; if wings with 5 Anal veins and no closed Radial cell, front trochantins hidden .... 15.

14. Mandibles with cavities, if present, opening dorsally; male hind tarsi 4-segmented; elytra with more or less distinct rows of punctures; front coxal cavities with lateral extensions broad, exposing large part of trochantin .... PHLOEOSTICHIDAE

--. Mandibles with cavities opening laterally; male hind tarsi 5-segmented; elytra without distinct rows of punctures; lateral extensions of front coxal cavities narrow, exposing only a small part of trochantin .... CAVOGNATHIDAE

15. Trochantins of front coxae broadly exposed; tarsal segment 1 at least as long as 2; retracted aedeagus not inverted; posterior constriction of head immediately behind eyes, no distinct temples; species not markedly flattened ...... BOGANIIDAE

--. Trochantins of front coxae narrowly exposed or hidden; tarsal segment 1 much shorter than 2, or front coxal cavities broadly closed behind; head constricted some way behind eyes, with distinct temples; species usually flattened 15a

15a. Male hind tarsi usually 4-segmented, tarsi never with segments markedly lobed below; front coxal cavities usually open behind, with narrow external slit-like extensions, or all coxae more or less widely separated; wings often with closed Radial cell .... CUCUJIDAE

--. Male hind tarsi 5-segmented, tarsi usually with segments 2-3 more or less lobed below and 4 small; front coxal cavities never with slit-like extensions, nor widely separated, usually closed behind; wings never with closed Radial cell .... SILVANIDAE

As defined in the above key, Silvanidae will include Uleiotinae (Hyliotinae), previously placed in Cucujidae. The Passandridae of Crowson (1955) clearly belong in the immediate neighbourhood of, if not actually in, the Cucujidae. A new key to the families of adult and larval Clavicornia is in preparation by the present author and T. Sen Gupta.

The Phloeostichidae show apparent affinities to Protocucujidae, and also to Cucujidae and Silvanidae, the former particularly through *Phloeostichus* and the latter by way of Hymaeinae; *Agapytho* seems to lean more towards Cavognathidae and Cryptophagidae. Cavognathidae seem to be linked with Phloeostichidae on one hand and Cryptophagidae on the other, but not evidently to any other Clavicorn families.

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GROOMING BEHAVIOR IN COLEOPTERA

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Abstract

Grooming movements in Coleoptera are divided into 3 categories: 1) cleaning: appendages are passed through the mouth; 2) rubbing: with one or more legs; and 3) positioning: involving adjustment of the elytra, wings, or abdomen. Cleaning movements involve placing an antenna, palpus, fore-, mid-, or hindleg in the mouth, either with or without the assistance of another leg. Rubbing involves all possible combinations of a leg with another appendage or body surface and includes both unilateral and bilateral movements. Positioning includes elytral raising, wing extension and retraction, wing unfolding and refolding, and various body movements. Twenty-one basic grooming acts and over 50 modifications are described. The literature is reviewed and there is a discussion of variation and its possible sources. Data are from the following 38 families: Alleculidae, Anobiidae, Anthicidae, Anthribidae, Apionidae, Attelabidae, Bostrichidae, Bruchidae, Buprestidae, Cantharidae, Carabidae, Cerambycidae, Chrysomelidae, Cicindelidae, Cleridae, Coccinellidae, Cucujidae, Curculionidae, Dermestidae, Elateridae, Histeridae, Lampyridae, Languriidae, Meloidae, Melyridae, Mordellidae, Nemonychidae, Nitidulidae, Oedemeridae, Ptilodactylidae, Pyrochroidae, Rhynchitidae, Scaphidiidae, Scarabaeidae, Scolytidae, Silphidae, Staphylinidae, and Tenebrionidae.

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Introduction

Grooming involves " . . . complex movements which are among the most stereotyped in all the . . . repertory." That comment about ants, by E. O. Wilson (1962), is generally applicable to Coleoptera. Beetles with missing or abnormal appendages attempt identical acts as normal individuals, even though the actual grooming is impossible. For example, the stump of a foreleg will rotate, the head will turn, the antennae will lay back, and the mouthparts will work to clean a fore tibia and tarsus accidentally lost. Wilson goes on to say that " . . . notes on a wide range of genera confirm that self-grooming behavior varies widely within the Formicidae and thus offers excellent new characters for evolutionary studies. It can be further noted that it is not the basic movements themselves that vary greatly, but rather the pattern of their presence or absence (p. 411)." In comparison, my notes on 33 families of Nearctic Coleoptera indicate that: 1) the grooming repertory of some is richer than that of ants; 2) there is considerable variation in basic movements, both within and between species; 3) the presence or absence of an item in the repertory may vary within individuals of the same species; 4) grooming offers excellent new characters for behavioral and evolutionary studies.

Before I describe the basic repertory of Coleoptera, a few miscellaneous problems require clarification or comment. I use the word "grooming" to describe the broad spectrum of activities under discussion; this includes several cleaning movements, but in other instances, the insect appears no cleaner after the act. The word "preening" was also considered, but in birds this can involve the transfer of oils to the areas involved; in beetles the passing of appendages through the mouth may be partly analogous, but rubbing the body with a leg or adjusting the wing position does not seem to be comparable. Grooming acts are performed at varying intensities; e.g., in the weevil genus *Conotrachelus,* the ipsilateral mid- and hindleg can be raised and rubbed slowly together with the tarsi clear of the substrate and the body stationary, or the act can be performed more rapidly with the tarsi alternately hitting the substrate and the body bumping up and down.

Grooming behavior can be classified in a variety of ways. It is important to distinguish between oral and pedal grooming. I restrict the word "clean" to situations where appendages are passed through the mouth, and I use the word "rub" for a variety of actions involving moving or progressive contact of a leg with another appendage or the general body surface. Not all grooming is included in these categories (e.g., the stereotyped unfolding and refolding of wings). A classification can also consider unilateral vs. bilateral movements, or simple (1 moving part) vs. complex (2 or more moving parts). In practice, all of these categories are useful. Basically, beetles clean legs, antennae, or palpi, with the mouthparts, they rub parts of the body or the antenna with one or more legs, they rub various legs together both unilaterally and bilaterally, and they reposition the elytra, wings, and other body parts. In some species, the sequence of rubbing acts results in the anterior movement of detritus to the mouth.

My observations utilized individuals of unknown age and history, brought into the laboratory, placed in 4 to 8 dram vials, and usually studied under a binocular microscope. Larger beetles were observed in containers commensurate with the size and agility of the insect. For most, a small plastic refrigerator crisper about 10 × 15 × 10 cm, lined with a damp paper towel, worked well. An effort was made to supply food, water, and traction. When possible, only healthy, active specimens were used. The material examined ranges from many dozens (some Anthribidae and cultured species) to only single specimens of a few families.

Many of the species studied are still incompletely determined, and additional material is added daily. I have limited this discussion to the family level, and reserved the details of species, localities, inter-, and intrafamilial variation for subsequent studies. Most of the taxa are common spring or early summer species in Ohio, others are common stored product pests, and lesser numbers have been collected in the Bahama Islands, Tennessee, Florida, Oklahoma, and Arizona. Almost all specimens are set aside in my personal collection, all are available for study by specialists, and all are labeled as having participated in these studies. I made or verified all observations.

GROOMING MOVEMENTS OF COLEOPTERA

CLEANING

(Appendages passed through the mouth; almost always unilateral)

1) *Antenna Clean.* Usually the fore tibia or tarsus reaches forward and upward over the ipsilateral antenna and pulls it down into the mouth where it is manipulated with a chewing motion. The mouthparts progress from near the antennal base to the apex, as the terminal segment is completed, the antenna springs free. The precision with which this movement is completed appears to vary widely. Some individuals position the antenna in the mouth almost every time, others of the same species need many attempts. Some species perform *Antenna Clean* with relatively high frequency, others seldom or never. Some beetles appear to combine *Head Rub* and the start of *Antenna Clean* in one continuous movement, in others the 2 are clearly separable; these 2 extremes grade into each other so that some observations cannot be allocated with certainty. In 1*a*: held, the customary method, the fore tibia or tarsus remains positioned transversely across the tips of the mouth parts and helps hold the antenna in place in the mouth; a curious variant mode occurs in Cleridae and Melyridae where the 2 forelegs can be crossed under the mouth to hold an antenna in place; in 1*b*: free, the foreleg is positioned in midair or returned to the substrate after pulling the antenna to the mouth, and the maxillae or mandibles hold the antenna in place; in 1*c*: unassisted, the foreleg is not involved, the antenna deflecting into the mouth due to its own musculature; this has been observed only in the family Cantharidae; in 1*d*: double, both antennae are passed simultaneously through the mouth with the aid of one foreleg, observed in Melyridae; and in 1*e*: contralateral, the antenna is pulled down into the mouth by the fore tarsus of the opposite side, observed only in the weevil family Rhynchitidae. *Antenna Clean* has been observed in 27 families of Coleoptera; it appears to be absent in most weevils, Carabidae, Cicindelidae, and some Cerambycidae and Meloidae.

2) *Foreleg Clean.* Usually the apical portion of a fore tibia and all of the fore tarsus is drawn through the mouthparts, however, some beetles include the femur. There is a continuum between deliberate passage of the foreleg with associated chewing motions, to very rapid passage without observable mouth movements—the leg appearing to slide rapidly through the mouthparts without being manipulated. During rapid passes, leg movement through the mouth can be unidirectional or back and forth, while in the slow "chewing" passes, the mouthparts progress apically to the tarsal claws. Three clearly different modes were observed (2 may be abnormal). They are 2*a*: ventral, the customary method where the leg is raised beneath the head, the tarsus

projects anteriorly, and the leg is drawn posteriorly; 2*b*: reverse, where the foreleg is raised in front of the face, the tarsus projects downward and posteriorly into the mouth, and is drawn anteriorly through the jaws, observed twice in one specimen of an undescribed species of Anthribidae; and 2*c*: bilateral, where both tarsi are drawn posteriorly through the mouth simultaneously, observed only in some Staphylinidae. *Foreleg Clean* has been observed or reported in 29 families, and appears absent in non-anthribid weevils and Cicindelidae.

3) *Midleg Clean.* The tarsus or tibia and tarsus of the midleg is drawn through the mouth usually with definite chewing motions, the claws last. There are 5 clear-cut modes. 3*a*: ventral, the midleg is brought forward beneath the body and the mouth dips downward and backward to reach it; observed in Anthribidae; 3*b*: lateral under, the midleg is turned forward alongside the body, the head turns to that side, and dips laterally and backward to reach it; in this mode the midleg crosses under the ipsilateral foreleg which can be raised or else remains on the substrate, observed in 5 families, Anthribidae, Anthicidae, Cantharidae, Cleridae, and Coccinellidae; 3*c*: lateral over, similar to the previous mode except the midleg crosses over the ipsilateral foreleg, observed in certain Anthribidae, Bruchidae, Cerambycidae, and Melyridae; 3*d*: lateral pull, where the foreleg hooks over the ipsilateral mid tibia and draws it forward so that the mouth reaches the mid tarsus, reminiscent of a praying mantis; observed only in 1 anthribid weevil; 3*e*: lateral push, where the midleg is moved forward and placed across and over the apex of the fore femur which is raised and used to push the mid tarsus to the mouth, this is one step beyond the lateral over mode (#3*c*), for the foreleg is raised from the substrate; has been observed in some Bruchidae and Cerambycidae. In addition to these 5 modes, anthribids and clerids have been observed with fore and mid tarsi of one side in the mouth simultaneously. This may be a distinct grooming act (*Fore-Midleg Clean*), but since the start of the act was not seen, it is presently considered an abnormal *Midleg Clean* where the foreleg got involved. *Midleg Clean* has also been reported in Meloidae and Oedemeridae (Jander, 1966).

4) *Hindleg Clean.* The hind tarsus is drawn through the mouth with definite chewing motions, the claws last. Three clear-cut modes occur, and the possibility of others exists. 4*a*: ventral, where the hindleg is brought forward beneath the body, and the head stretches downward and backward so that the mouth reaches the hind tarsus; this can be assisted or not by the mid tarsus; known only in Anthribidae; 4*b*: fore pull, can be achieved in 2 ways, where the hindleg is rotated forward lateral to the body and the foreleg is hooked over it and draws it forward so that the mouth reaches the hind tarsus, in Anthribidae and Anthicidae, and where the hindleg is raised vertically, then continues forward until the foreleg hooks over it and pulls it down to the mouth; known only in Anthicidae; the latter variant can end with the hindleg either over or under the midleg, both being observed in the same individual. 4*c*: mid pull, same as the first variant of 4*b*, except the midleg pulls the hind to the mouth, known only in Anthribidae.

5) *Palpus Clean.* The palpi of one side are curled into the mouth and chewed by the maxillae, with the mandibles or fore tarsus helping to maintain the position, observed several times in Anthicidae, Cantharidae, Cleridae, and Ptilodactylidae.

RUBBING

(With one or more legs; unilateral unless stated otherwise)

6) *Antenna Rub.* Portions of a fore tarsus or tibia are rubbed along the dorsal surface of the ipsilateral antenna, starting at or near the base and progressing distally. This action can be performed while standing or walking (even rapidly), and in several very distinct modes; 6*a*: substrate, where the antenna is stepped on by the ipsilateral foreleg (by the midleg in a few Anthribidae and Chrysomelidae), pressed against the substrate, and pulled clear; 6*b*: aerial, where the foreleg rubs along the antenna in mid-air anterior or lateral to the head and the antenna remains clear of the substrate; 6*c*: bilateral, where each antenna is rubbed by its ipsilateral foreleg simultaneously, can be in either substrate or aerial modes, has been observed in 8 widely different families; 6*d*: contralateral, where the head is turned to one side and the more ventral antenna is rubbed by the foreleg of the opposite side, has been seen in Curculionidae; 6*e*: bipedal, where the antenna is pulled or rubbed between the appressed ipsilateral fore- and midlegs, this occurs in some Cerambycidae and Chrysomelidae, and explains the function of the grooves on the fore and mid tibiae of the cerambycid subfamily Lamiinae; 6*f*: retracted, where the antenna is withdrawn under the head and rubbed with the dorsal surface of the foreleg in an anterior to posterior "come-hither" motion, observed in Bostrichidae and Scarabaeidae; 6*g*: ventral, where the foreleg contact is on the underside of the antenna, observed once in Anthribidae; 6*h*: double, where both antennae are rubbed simultaneously by one foreleg, also observed once in Anthribidae. *Antenna Rub* has been observed in 29 families; the many modes (and the subtle variations not detailed here) indicate the need for much additional study.

7) *Head Rub.* Portions of a fore tarsus or tibia are passed over any part of the head. Usually there is an accompanying coordinated head movement which facilitates reaching the area to be rubbed. In Anthicidae, Anthribidae, Bostrichidae, Bruchidae, Cerambycidae, Cleridae, Coccinellidae, Elateridae, and Lampyridae, the *Head Rub* can originate on the prothorax, but in most beetles it is restricted to the head; 7*a*: unilateral, is the customary act; 7*b*: bilateral, where both forelegs are used simultaneously or alternately; occurs in scattered families. When alternate, the choice between unilateral and bilateral modes can be arbitrary, I have based it on the speed, degree of continuity, and the extent to which both forelegs are off the substrate at the same time. Although *Head Rub* has been observed in 31 families, it clearly is not as variable as *Antenna Rub.* One probable source of variation which has not been investigated is the position of antennae during the act.

8) *Body-Midleg Rub.* Portions of a mid tibia or tarsus are rubbed over the surfaces of the head (rarely), pterothorax, or abdomen; 8*a*: unilateral, is the customary mode, observed in 23 families; 8*b*: bilateral, is infrequent in beetles, having been observed in Cantharidae, Cerambycidae, Cicindelidae, Cleridae, Curculionidae, and Lampyridae. The most extensive movement was seen in some Anthicidae and Curculionidae, where the midleg was able to rub the entire dorsal surface from the eyes to the pygidium.

9) *Body-Hindleg Rub.* As in number 8, but the hindleg is used. Present in most beetles studied adequately (30 families) and may be universal in the Coleoptera. The leg motion can be in anterior-posterior sequence or, more rarely, back and forth. In addition to the major modes, 9*a*: unilateral; and 9*b*:

bilateral; there appear to be important differences in the parts of the body contacted. These include the usual dorsal, lateral, and ventral surfaces, and also 2 rare modifications: alar, where the elytron is raised and the hind tarsus rubs the dorsum of the wing; seen in some Anthicidae, Attelabidae, Bruchidae, Cerambycidae, Cleridae, and Melyridae; and tergal, where the elytron and wing are both raised and the hind tarsus rubs the abdominal tergites (or perhaps the wing venter?) as in Anthicidae, Attelabidae, Bruchidae, Cantharidae, Cleridae, Melyridae, and Staphylinidae. A possible third mode, rudimentary, (perhaps abnormal) was observed in the weevil genus *Lechriops,* where the femur swings anteriorly and posteriorly, the tibia kicks, and the tarsus twitches, but the leg does not contact the body. In some Bruchidae the act can involve the dorsum of the head.

10) *Body-Mid-Hindleg Rub.* Essentially a combination of numbers 8 and 9, where mid- and hindleg of one side are simultaneously rubbed over the dorsum of the body. In 10*a*: sequential, the hindleg remains posterior to the midleg; in 10*b*: reversed, the 2 legs are crossed, the hind tarsus being anterior to the mid tarsus during the act. Of the 14 families with this type of grooming, only the Bruchidae utilized the reversed mode; 2 (Anthribidae and Cantharidae) have a rare bilateral variant, and 1 (Melyridae) has alar and tergal options as outlined in #9 above.

11) *Body-Mid-Mid-Hindleg Rub.* This 3-legged movement has been observed only in Cerambycidae and Melyridae.

12) *Body-Mid-Hind-Hindleg Rub.* This is the other 3-legged body rub; it occurs in some Cerambycidae and Chrysomelidae.

13) *Bilateral Foreleg Rub.* The 2 forelegs are entwined or rubbed together. There are 2 basic positions, 13*a*: anterior, where the legs reach around the head and the rubbing is anterior to it; 13*b*: posterior, where rubbing takes place beneath the head, posterior to the mouthparts. The former mode occurs in Attelabidae (Daanje, 1964) and various Curculionidae, the latter in some other Curculionidae as well as Cerambycidae and Melyridae. The act has also been observed in Cleridae, but the mode was not recorded.

14) *Fore-Midleg Rub.* Fore and mid tarsi or tibiae and tarsi of one side are entwined or rubbed together. This movement varies greatly in frequency and may be absent in some individuals or species. There are 2 modes for this movement but they can be combined in some species; 14*a*: substrate, where 1 leg, usually the middle, does not leave the substrate and is rubbed by the other; 14*b*: raised, where both legs are lifted and rubbed together. In some beetles both tibia and tarsus are involved; in others, only the tarsus. This common movement has been seen or reported in 30 families of Coleoptera.

15) *Mid-Hindleg Rub.* Mid and hind tarsi or tibiae and tarsi of 1 side are entwined or rubbed together. The modes 15*a*: substrate, and 15*b*: raised, are as in 14 above and can run together or alternate in a single bout of grooming; however there is a third mode 15*c*: bilateral, which involves simultaneous rubbing together of all 4 mid- and hindlegs beneath the abdomen. The customary substrate or raised modes occur in 30 families of beetles, while the rare bilateral mode has been seen in Anthribidae, Cantharidae, Cerambycidae, Chrysomelidae, Curculionidae, and Nemonychidae.

16) *Bilateral Hindleg Rub.* The 2 hindlegs are rubbed together beneath the abdomen. Observed in 18 beetle families.

17) *Fore-Mid-Hindleg Rub.* In this curious action, the 3 legs of 1 side are brought together and rubbed simultaneously. Observed in Anthicidae,

Bruchidae, and Staphylinidae. In the last family the body is tilted and curved, supported by a tripod of 3 legs, and the rubbing motion is raised, not substrate. In some Anthicidae the midleg is never or seldom used; this can result in a *Fore-Hindleg Rub.*

POSITIONING
(Unilateral or bilateral)

18) *Elytra Raise.* A rapid rise and fall of the elytra usually with slight separation. This is the most widespread positioning movement, but detailed records for this and the following actions are incomplete.

19) *Wing Extend.* The wing apex is straightened and extended to its full length beyond the abdomen, and then retracted more slowly. In this action the wing remains folded longitudinally and is not ready for flight. This movement can be preceded by *Elytra Raise* (#18), and is sometimes accompanied by various modes of *Body-Hindleg Rub* (#9). The extension can be sudden or laborious and can be assisted or not by abdominal pulsations; the retraction is usually gradual and may or may not be assisted by the abdomen. For example, in some Bruchidae the abdomen functions in wing retraction but not extension, and in Curculionidae the abdomen functions in both. During abdominal assistance, the elytra are usually closed.

20) *Wing Unfold.* The elytra and wings are raised and spread, and the wings are completely unfolded, as if for flight; then refolded. The refolding can involve abdominal assistance.

21) *Vessicle Extend.* Membranous intersegmental vessicles are inflated by body contraction and then withdrawn into the body out of sight. This is done during a bout of grooming interspersed with various other movements, and does not appear correlated with response to external stimuli. Observed in an unidentified melyrid which has a large curved Y-shaped yellowish-gray vessicle on each side in the membrane between the metacoxa and the abdomen. The insect groomed various external parts, then braced itself, curled and contracted the abdomen to the side, extended and retracted 1 vessicle in a smooth continuous motion, resumed other grooming, and then repeated the procedure on the other side.

DISCUSSION

A number of factors clearly affect the overall picture of grooming activity; there are probably many others. The most important of these is the fact that the complete grooming repertory is not always seen in 1 individual, even after hours of observation. This can be due in part to varying grooming intensity, for it is clear that some beetles have 2 different repertories which are involved at different times. There can be a frequently observed routine involving mostly *Body* and *Leg Rubs,* and a special repertory, observed infrequently, involving oral cleaning and some rubbing acts. Since the stimuli which initiate each type of grooming activity have been incompletely checked (by experimental application of dusts, water, irritant liquids, pressure, etc.), it sometimes requires long observation to obtain a reasonably complete picture. It is also clear that the state of activity affects grooming, (e.g., some beetles appear to groom at almost any time, while others do little or no grooming when disturbed and have a more complete repertory shortly before settling down and becoming immobile). The nature of the substrate has an effect involving traction and probably chemoreception; some beetles have an incomplete repertory in an empty vial, and a more diverse one when they can stand on a piece of bark or dead leaf. The availability of food and water seems to stimulate either the frequency or diversity of grooming in at least some cases and undoubtedly is involved also in the substrate reaction. Inadequate atmospheric humidity, varying temperature, light intensity, past contact with insecticides, age, and nutritional history all introduce variables which affect the grooming repertory. Finally, in some vertebrates, grooming is a common form of displacement activity; it is not clear to me if this applies to grooming in Coleoptera.

Knowledge of grooming behavior in the Coleoptera is still in its infancy. It was hoped that the literature might fill some of the gaps, but very few papers mention beetle grooming behavior. In Attelabidae, Daanje (1964), discussing *Deporaus betulae* (L.), mentions what I have called *Antenna Clean, Head Rub, Antenna Rub, Body-Midleg Rub, Body-Hindleg Rub, Fore-Midleg Rub, Mid-Hindleg Rub,* and *Hind-Hindleg Rub*; and for *Apoderus* he mentions a *Fore-Foreleg Rub.* In Bruchidae, Forister and Johnson (1971) mention a male *Acanthoscelides prosopoides* which, during copulation, groomed " . . . his legs and antennae with his fore legs . . . with his hind legs balancing him." I interpret this as *Antenna Rub* and *Fore-Midleg Rub,* which coincides with my observations of the same genus. In Carabidae, Hlavac (1972) presents a fine discussion of the fore tibial antenna scraper, and for *Scaphinotus* and *Pristonychus* describes *Foreleg Clean, Antenna Rub,* and *Fore-Midleg Rub.* In Cerambycidae, Chemsak and Linsley (1971) observed in *Rosalia funebris* what appears to be an incomplete bilateral *Antenna Rub* involving only the scapes; Chemsak and Powell (1971) mentioned that *Leptalia macilenta* utilizes *Antenna Clean, Foreleg Clean,* and *Fore-Midleg Rub*; and B. D. Blair (pers. comm.) has seen *Antenna Rub* in *Dectes.* In Elateridae, Lilly (1959) mentions *Antenna Rub* in *Limonius californicus* in response to very dilute hydrochloric acid. My data for several species each of Carabidae, Cerambycidae, and Elateridae verify and extend these reports. In Meloidae, Selander (1964) states that *Pyrota nigrovittata* grooms the fore legs (? with the mouth) and the body with the hind legs; Selander and Pinto (1967) point out that in *Meloe, Lytta,* some *Linsleya,* and *Pyrota* the antennae are cleaned with the mouth, while in *Epicauta,* some *Linsleya* and *Pleuropompha* the antennae are groomed with a special groove on the fore leg; Selander and Mathieu (1969) mention what I call *Foreleg Clean, Midleg Clean, Antenna Rub, Head Rub, Body-Midleg Rub, Body-Hindleg Rub,* and *Mid-Hindleg Rub* in *Epicauta*; the two *Body-Leg Rubs* also include rubbing the metathoracic wings.

In the most important paper on grooming in Coleoptera, Ursula Jander (1966) has provided an overview of the tracheate arthropods, including 14 families and 31 species of beetles. Among these, the broadest coverage is of Cerambycidae (6 species) and Carabidae and Silphidae (4 species each). Only 1 representative of Chrysomelidae was studied and 3 of Curculionidae (*sensu lato*). Jander's work utilizes only 8 grooming movements: *Antenna Clean* (my #1), *Foreleg Clean* (#2), *Midleg Clean* (#3), *Antenna Rub* (#6) in both unilateral and bilateral modes, *Fore-Midleg Rub* (#14), *Mid-Hindleg Rub* (#15), *Hind-Hindleg Rub* (#16). None are universal within the order. In the English summary she states (p. 842) that (with few exceptions) myriapods, thysanurans, and orthopterans (*sensu lato*) " . . . groom the antennae and all of the legs with the mouthparts. This method is therefore to be regarded as the primordial mode of grooming in the Tracheata . . . No grooming of the hindlegs with the mouthparts was observed among beetles. However, Cantharidae and Oedemeridae are still able to groom the antennae and the first two pairs of legs with the mouthparts. In other beetle groups, these primordial grooming actions are partially or entirely replaced (by rubbing with the legs)." Because hindleg cleaning (with the mouth) was not observed in beetles, Jander isolates the order in a grooming level (her Fig. 21) between the primitive myriapod-thysanuran-orthopteran pattern (mouth usually cleans all appendages) and the remaining Insecta (antennae and then 2 or 3 pairs of legs cleaned by the legs, not by the mouth). The families Anthribidae and Anthicidae destroy this distinction and broaden the diversity of the Coleoptera to overlap the grooming level of the primitive tracheates. Jander's diagram does not show the variation of the various orders, but only the maximum degree of oral grooming present in the group. Jander's concept that oral grooming is primitive is probably true among tracheates generally, but in Coleoptera mid- and hindleg cleaning is associated primarily with species which contact pollen, spores, or other finely particulate substrates.

Among the better studied families of Coleoptera, the most diverse patterns presently are found in the families Anthicidae, Anthribidae, Bruchidae, Cerambycidae, Chrysomelidae, Cleridae, Coccinellidae, Melyridae, and Staphylinidae. Looking at grooming diversity in the order, it is clear that some movements will provide much more information for studies of comparative behavior and evolution than others. The most obvious are the cleaning movements (oral grooming) and the more unusual types of rubbing movements (pedal grooming). The known distribution of these acts has been outlined above; their interest and importance in future studies is self-evident.

Although no grooming movement occurs throughout the order, most of the beetle species studied to date have a basic pattern of 5 similar grooming movements (#6, 7, 9, 14, 15). Studies of these basic acts should include: verification of their presence or absence in additional taxa, search for distinctive modes and postures during these movements, and recording the sequence of grooming actions to provide clues to the evolution of this behavior, and suggest functional or genetic similarities between taxa.

Every family studied grooms the antennae, either by *Antenna Clean* or *Antenna Rub,* and most do both. Every family studied (except the Scarabaeidae) grooms the forelegs by either *Foreleg Clean* or *Fore-Midleg Rub,* or both. Scarabs probably do it too, but data on them is fragmentary. Reduction of oral grooming is strongly correlated with either special rubbing structures or techniques. The corbels and other spiny tibial fringes of weevils are literally used as combs to rake the ventral tarsal surfaces, and the protibial scrapers of Carabidae, the protibial groove of some Meloidae, and the mesotibial groove and protibial sinus of lamiine Cerambycidae are all used for antennal grooming, and occur in species where *Antenna Clean* has not been reported. The absence of special structures can be balanced by special techniques. In weevils, where one of the principal evolutionary trends has been the reduction and consolidation of the mouthparts, *Antenna Clean* is absent in the vast majority of species, however *Antenna-Foreleg Rub* is performed in 4 different modes (substrate, aerial, bilateral, and contralateral), and some species utilize 3 of the 4 possibilities.

The correlation of grooming behavior with current ideas of beetle classification is still difficult to predict, for the similarities and differences between taxa may be artifacts of the sample. Fourteen beetle superfamilies are represented, but by relatively few species. It is clear that many families are different; for example, all 9 genera of Tenebrionidae examined include 8 major grooming movements, while 2 species of Anthicidae include 16 major movements and many variations, and 3 genera of Scarabaeidae include only 4 movements (all in 1 specimen). The quantity (and quality) of these differences correlates best with activity and habits, not phylogeny, and I suspect this is the principal pattern. At present, the only clearcut relationship between grooming behavior and phylogeny is the rapid reduction and loss of oral grooming in the derivative Rhynchophora, and the concomitant development of special rubbing structures and movements. The loss of oral antennal cleaning in Adephaga, at the opposite end of the order, clearly indicates that this type of behavior (and others) can arise independently within the order.

SUMMARY

1) Data on grooming are presented for 38 families of Coleoptera: Alleculidae, Anobiidae, Anthicidae, Anthribidae, Apionidae, Attelabidae, Bostrichidae, Bruchidae, Buprestidae, Cantharidae, Carabidae, Cerambycidae, Chrysomelidae, Cicindelidae, Cleridae, Coccinellidae, Cucujidae, Curculionidae, Dermestidae, Elateridae, Histeridae, Lampyridae, Languriidae, Meloidae, Melyridae, Mordellidae, Nemonychidae, Nitidulidae, Oedemeridae, Ptilodactylidae, Pryochroidae, Rhynchitidae, Scaphidiidae, Scarabaeidae, Scolytidae, Silphidae, Staphylinidae, and Tenebrionidae. Ninety-eight genera in 33 families have been observed by me, and an additional 33 genera and 5 families are briefly or incompletely mentioned in the literature.

2) Grooming behavior varies in both the presence and performance of an item in the repertory, and can be affected by the individual's state of activity, substrate, availability of food and water, temperature, light, humidity, exposure to insecticides, age, and nutritional history.

3) Distinction should be made between oral grooming (cleaning) and non-oral grooming (rubbing and positioning), between uni- and bilateral movements, and between 1 moving part (simple) and 2 or more coordinated moving parts (complex).

4) The most widespread grooming movements in Coleoptera are *Antenna Clean, Foreleg Clean, Antenna Rub, Head Rub, Body-Hindleg Rub, Fore-Midleg Rub,* and *Mid-Hindleg Rub.* The last 5 (the rubbing movements) have been seen in most beetles, but at present no movement is universal in Coleoptera.

5) Several species of Anthribidae and Anthicidae are the only known beetles which can clean the hind tarsi with the mouth. In fact, Anthribidae have 4 ways of doing this, and Anthicidae have 2. According to Jander (1966), this is "primordial" among tracheate arthropods.

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WILSON, E. O. 1962. Behavior of *Daceton armigerum* (Latreille), with a classification of self-grooming movements in ants. Bull. Mus. Comp. Zool. 127(7):401-421; Fig. 1-2, Tab 1.

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BOOK REVIEW

Readings in Entomology by Pedro Barbosa and T. Michael Peters. 1972. W. B. Saunders Co., West Washington Square, Philadelphia, Pa. 19105. 450 p.; 303 Fig. (7 1/4" × 10 1/4"). Paperbound, $6.50.

As the title indicates, this is a collection of articles which previously appeared in scientific journals. Although designed primarily to up-date and supplement college texts, it is worthwhile reading for those entomologists who graduated some time ago. The most difficult task for the authors was to make the selections from such a mountain of relative literature. The "Annual Reviews" try to cover the same thing except by review articles in a particular subject.

The idea of reproducing published papers in such a collection presents an inexpensive printing method. No composition costs are involved because camera ready copy is used. The illustrations suffered in some cases, but otherwise the result is adequate.—R. E. Woodruff

A NEW NAME FOR *HARPALUS (GLANODES) PUNCTICEPS* (CASEY) (COLEOPTERA: CARABIDAE)

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C. H. Lindroth (*in litt.*) pointed out that the name *Harpalus (Glanodes) puncticeps* (Casey 1914: 61), used in a recently published study of *Glanodes* (Ball 1972: 192), is a junior secondary homonym of the name *Harpalus (Ophonus) puncticeps* (Stephens 1828: 163). Therefore, the name proposed by Casey must be replaced. Because no other names are available for this purpose, I propose *Harpalus cunctipeps* New Name, the trivial epithet being an anagram of *puncticeps.*

The Stephens name is listed by Csiki (1932: 1110) as a junior synonym of *Harpalus (Ophonus) puncticollis* (Paykull 1798).

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Book Review

Prairie Plants and Their Environment by J. E. Weaver. 1968. University of Nebraska Press, Lincoln, Nebraska. 276 p., 100+ photos. Cloth, $6.95.

The word "prairie" probably conjures up various pictures in the mind, but most of them relate to the vegetation. Beetle collectors are certainly conscious of the many species that occupy this extensive major habitat. Although the diversity of plants and animals superficially seems small, it probably harbors as many endemics as any other. As collectors we tend to think more often of exciting areas such as mountains, deserts, and the tropics, but we would do well to devote more time to the "prairie".

The author was one of those fortunate to spend 50 years of research in a single area of study. There is no substitute for such long devotion to the subject and many unique insights have resulted. The work was published posthumously, but it was completed just prior to the author's death—a fitting tribute to a productive life.—R. E. Woodruff

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TWO NEW SPECIES OF *MESOCORDYLUS* FROM MEXICO AND COSTA RICA (COLEOPTERA: CURCULIONIDAE: RHYNCHOPHORINAE)

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Abstract

Mesocordylus excisus and *similis* are described from Mexico and Costa Rica, respectively.

The 2 species of the weevil tribe Sipalini described below were sent to me, with the exception of 2 specimens in the American Museum of Natural History, by Mrs. Anne Howden of Ottawa and Dr. Robert E. Woodruff of Gainesville, Florida. Both species were collected at high elevations. These additions bring the total number of species of this Neotropical genus to 26.

Mesocordylus excisus Vaurie, NEW SPECIES

(Fig. 1, 2, 8-12)

Type, male, from 15 mi. S of Valle Nacional, Oaxaca, Mexico, 4,000 feet, 20-V-1971, H. Howden, and male paratype with same data in Howden Collection, Ottawa, Canada; 32 mi. S of Valle Nacional, 7,000 feet, 21-V-1971, H. Howden, 1 male in Howden Collection; 8 mi. S of Teziutlan, Puebla, Mexico, 6,575 feet, 30-VII-1955, P. and C. Vaurie, a male and female in the American Museum of Natural History.

Diagnosis: Resembling *scutellaris* and *bracteolatus,* but differing from them by having larger apical spongy part of antennal club (Fig. 11-12); bare, broadly cavernous, excised sides of beak showing basal tooth (Fig. 1, 2); male beak (dorsal view) with parallel sides, not narrowing to apex.

Range: Highlands of central and southern Mexico.

Type, male: length 10 mm. Dark red, shining. Beak densely punctate, feebly arcuate; viewed dorsally, feebly wider in front of scrobes than behind, medially carinate with sides behind scrobe virtually straight; laterally, beak only feebly narrowed to apex; ventrally, carinate at middle with sides below rather tumid; antennal scrobe or groove with lower edge slightly dilated, visible from above; anterior edge of scrobe in apical third of beak; base of beak on sides bare of tomentose or spongy areas, thus exposing wide expanse of excavated area. Antennal scape long, about 4 times longer than width at apex; club longer than wide, with spongy apical part slightly more than 1/2 length of club. Pronotum appearing longer than wide, finely, rather densely punctate; punctures larger than those of elytral intervals; sides feebly arcuate; apex deeply transversely incised. Elytral intervals rather flat, 3 to 4 times wider than striae, with flat buffy ringed punctures in single rows; strial punctures obscured. Tibiae slightly incurved at apex; on inner side with sparse hairs. Tarsal segments elongate with short ventral hairs. Aedeagus at apex V- or U-shaped; long, coiled flagellum present.

VARIATIONS FROM TYPE: The male paratype from Teziutlan is only 8 mm long, whereas the female from the same locality is 16 mm; 1 male from the type locality is large also (15 mm), and 1 is small (11 mm). The female (17 mm) differs by having the beak in dorsal view narrower and less punctate in front of the scrobes, the underside of the beak feebly carinate medially and smooth on the sides, and the antennae inserted farther back, nearer the middle of the beak (Fig. 2). In the paratypes the strial punctures of the elytra are readily visible. In addition to the variation in size, there is variation among the paratypes in color (2 are black), in the club, and in the aedeagus. In the specimen from 7,000 feet at Valle Nacional the spongy part of the club is only about 1/2 the length of the club, not longer than 1/2. This paratype differs also slightly in the shape of the apex of the aedeagus (Figs. 9, 10). (Similar variability of the aedeagus has been found in *M. scutellaris.*)

DISCUSSION: This is the third species found in Mexico. *M. mexicanus* Vaurie is recorded (Vaurie, 1970) from the Isthmus of Tehuantepec west on the coast north to the state of Sonora; *M. bracteolatus* Boheman from localities in Veracruz and from Temascal, Oaxaca (it ranges southward to Guatemala and to Panama); in Oaxaca a female was collected on 17-V-1971, by Howden at the type locality of *excisus,* but at 3,000 feet. Both species differ from *excisus* in the shorter apical spongy part of the club, in the tomentose or much less excavated sides of the beak, and in the absence of a readily visible double angulation at the base of the beak. I believe *bracteolatus* has such an angulation, but it is hidden by the thick, tomentose coating. *M. excisus* agrees well with the description of *M. abditus* Vaurie (1970:36) from Panama, but the aedeagus of that species is only shallowly, not deeply, emarginate, and the scrobes are more widely dilated. All specimens were dissected.

Mesocordylus similis Vaurie, NEW SPECIES

(Fig. 3-7)

Type, male, Coronado, Costa Rica, 3-VI-1967, E. B. Fagan, in the Florida State Collection of Arthropods, Gainesville; paratype, female, with same data except date 1-VI-1967, to be deposited in the American Museum of Natural History.

DIAGNOSIS: Similar to *mexicanus* in proportions of club and in virtually non-dilated antennal scrobes, but pronotum narrower, with less arcuate sides, not so bulbous, and with stronger apical impression; elytra more elongate, more than twice length of pronotum; hind tibia wider at apex; beak of female same as that of male, in dorsal view not narrowed in front.

RANGE: Known only from the type locality for which more complete data is Finca Joseph Smids, San Isidro de Coronado (15 miles northeast of San Jose), 5500 feet elevation. The 2 specimens were taken at blacklight traps.

Type, male: length 12 mm. Dark red, shining. Beak in basal half densely punctate, toward apex less punctate; feebly arcuate; dorsally same width in front of as behind scrobes, with sides behind scrobes straight; laterally, beak strongly narrowed to apex; ventrally carinate at middle with sides behind apex rounded, but not tumid; antennal scrobe with lower edge scarcely dilated and barely visible from above; anterior edge of scrobe only slightly in front of middle of beak; base of beak on sides not tomentose. Antennal scape short, not quite 3 times longer than width at apex; club as wide as long, with spongy apical part nearly 1/2 length of club. Pronotum as described for *excisus* but punctures of disc faint or obsolete and other punctures same size as those of elytral intervals. Elytral intervals rather convex, less than twice width of striae; suture with double, other intervals with single rows of small, flat, buffy ringed punctures separated longitudinally by their diameter or twice their diameter; strial punctures larger. Tibiae on inner side with sparse hairs; front tibia straight; hind tibia incurved at apex where feebly widened. Tarsi as described for *excisus*. Aedeagus at apex very broadly U-shaped; long, coiled flagellum present.

VARIATION FROM TYPE: The female paratype is 13 mm long, but is otherwise like the male.

DISCUSSION: Except for the 8 species of the genus that are known from 1 sex only, *similis* is the only species in which no appreciable external sexual difference has been found, the shape of the beak being the same in both sexes. The lower edge of the scrobe, however, is actually slightly dilated and feebly visible from above in the male, but not in the female. *M. bracteolatus* and *M. scutellaris* (Costa Rica and South America) differ from *similis* by having the sides of the beak behind the scrobes angulate when viewed dorsally and the scrobes of the male widely dilated. In all 3 species the spongy apical portion of the club is proportionally shorter than that of *mexicanus* or *excisus* (Mexico). Both specimens of *similis* were dissected.

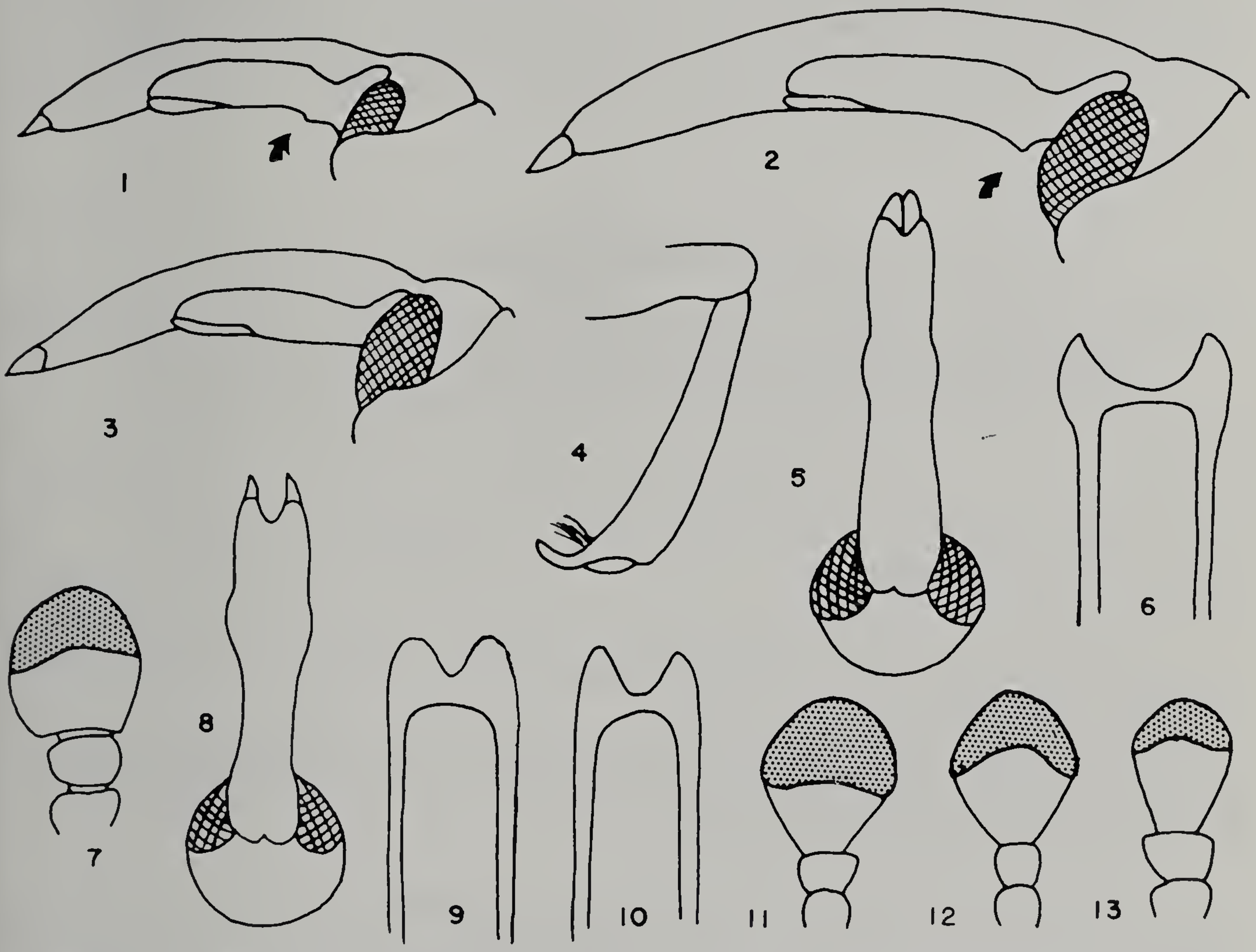

Fig. 1-13: *Mesocordylus*. 1, 2. *M. excisus*, beak: 1) male, 2) female. 3-7. *M. similis*: 3) beak, 4) hind tibia with feeble apical widening, 5) beak, male, dorsal. 6) apex aedeagus. 7) antennal club. 8-12. *M. excisus*: 8) beak, male, dorsal. 9) apex aedeagus, Valle Nacional, 7,000 feet. 10) apex, type and other paratypes. 11) antennal club, type, 12) club, Valle Nacional, 7,000 feet, 13) club, *M. bracteolatus*.

KEY CHARACTERS

In my key (Vaurie, 1970:13) these 2 new species would come to couplet 14 where the female, but not the male, of *similis* would key to *mexicanus*; *excisus* would proceed to couplet 15 where it would not agree with either statement, but the female might key to *mexicanus*. Couplets 13 and 14 therefore may be substituted by the following:

13a.	Beak at base ventrally bidentate; sides of beak bare and cavernous, without spongy coating; Mexico	*excisus*
	Beak at base ventrally either not dentate or teeth and sides of beak hidden by yellowish spongy coating; Mexico and elsewhere	13B
13b.	Pronotum behind apex incised deeply from side to side	14
	Pronotum behind apex not or only moderately impressed medially, but may be incised laterally	16
14.	Antennal club about as wide as long, appearing round	14A
	Antennal club longer than wide, appearing elongate	15
14a.	Pronotum at middle of strongly arcuate sides as wide as elytra; apical impression usually not well marked; hind tibia straight; Mexico	*mexicanus* (part)
	Pronotum at middle of feebly arcuate sides narrower than elytra; apical incision deep; hind tibia incurved at apex; Costa Rica	*similis*

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VAURIE, PATRICIA. 1970. Weevils of the tribe Sipalini (Coleoptera, Curculionidae, Rhynchophorinae) Part 2. The genera *Mesocordylus* and *Orthognathus*. Amer. Mus. Novitates 2441:1-78; Fig. 1-77.

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BOOK REVIEW

Cinematographic Techniques in Biology and Medicine, edited by Alexis L. Burton. 1971. Academic Press, Inc., 111 Fifth Ave., N.Y., N.Y. 10003. 394 p., profusely illustrated. Cloth, $19.50.

For those who want only casual movies to those wanting sophisticated shots of behavior, this book covers the subject thoroughly. It details the properties, storing, handling, and processing of film; equipment (cameras, lighting, light meters); techniques (including microscope adaption, time lapse, title preparation, and simple animation; procedures for editing, analyzing, and abstracting films and the recording and transfer of sound; and the application of television to biology and medicine. A superior book that will open wide your aperture to a fascinating subject.—R. E. Woodruff.

A SUPPLEMENT TO THE BOMBARDIER BEETLES OF NORTH AND MIDDLE AMERICA: NEW RECORDS FOR MIDDLE AMERICA (COLEOPTERA: CARABIDAE)

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Introduction

Since my revision of the bombardier beetles (1970), additional specimens have come to my attention. Many of these were collected in Central America, and it is the purpose of this paper to report on these in preparation for a forthcoming Central American faunal study. In this material, there are 5 species not previously recorded from Central America, although 4 of them were known from Mexico. The fifth was known only from South America. I have not discussed this latter species before. It is here redescribed and illustrated. New locality records are given for 3 other previously recorded species. A new synonymy is noted for a widely distributed North, Middle, and South American species. The arrangement of species here conforms to that proposed before (Erwin, 1970). *Brachinus bilineatus* Castelnau is here determined to be phylogenetically a member of the *lateralis* group (Erwin 1970:73). My earlier key (1970) is modified in order to accommodate *B. bilineatus.*

Key to North and Middle American Striped *Brachinus*

3(1′). Elytron with ferrugineous sutural or discal stripe, contrasting strongly with the otherwise darkly colored disc; elytral epipleura pale 4a
3′. Elytra concolorous; epipleura pale or dark 5

4a(3). Elytron with ferrugineous stripe along suture only 4b
4a′. Elytron with diagonal ferrugineous stripe extended from humerous to medial apex .... *B. bilineatus* Castelnau

4b(4a). Legs (at least tibiae) pale, with dark knees; palpi pale; elytra other than stripe usually greenish .... *B. cinctipennis* Chevrolat
4b′. Legs totally black; palpi infuscated to black; elytra other than stripe usually bright blue .... *B. cibolensis* Erwin

Brachinus geniculatus Dejean

Brachinus geniculatus Dejean 1831:428. Lectotype, here selected, a male, in MHNP! *Type locality*: "environs de Carthagène" that is, Cartagena, Colombia.

Brachinus rhytiderus Chaudoir 1876:76. New Synonymy. My use of this name in 1970 was a result of not having seen the type of *B. geniculatus* Dejean. *Description.*—See Erwin, 1970.

NOTE: This species was recorded previously from Central America, but the following localities provide additional site records. The range, as known now, extends from Texas south to at least northern Colombia.

ADDITIONAL DISTRIBUTION: COSTA RICA: (Irazu) USNM: (La Caja) USNM; (Navarro Farm) USNM: (San Jose) USNM. GUATEMALA: (Amatitlan) USNM; (Chimaltenango) USNM. NICARAGUA: (Managua City) USNM. EL SALVADOR: (San Salvador) USNM. PANAMA-CANAL ZONE: (La Chorrera) USNM; (Pipeline Road at Rio Agua Salud) USNM.

Brachinus sallei Chaudoir

(See Erwin, 1972, for discussion of the type specimen)

NOTE: This species was previously recorded only from Mexico at localities in Campeche, Chiapas, Quintana Roo, San Luis Potosi, Tabasco, and Veracruz.

ADDITIONAL DISTRIBUTION: GUATEMALA: (Cayuga) USNM.

Brachinus bilineatus Castelnau

(Fig. 1, 2, 3, 4)

Brachinus bilineatus Castelnau 1835:59. Lectotype, here selected, a male, in Paris Mus. Nat. Hist. *Type locality*: Cayenne, French Guiana.

Brachinus insignis Brullé 1837:21. Synonymized by Chaudoir 1876:86. *Type locality*: Santa Fe Province: Rio de Corrientes, Argentina.

Brachinus obliquus Brullé 1837:21. Synonymized by Chaudoir 1876:86. *Type locality*: Santa Fe Province: Rio de Corrientes, Argentina.

DIAGNOSTIC COMBINATION: The longitudinally diagonal ferrugineus stripe on each elytron is unique to members of this species.

DESCRIPTION: Medium-sized, 9.0 to 11.5mm.

Color: Meso- and metasternum and abdomen at least at sides infuscated, middle usually more rufous; forebody and elytral stripes ferrugineous; appendages variable, except infuscated antennal articles 3 to 11.

Microsculpture as described for genus (Erwin, 1970).

Macrosculpture. Frons laterally and pronotum in lateral channels transversely but shallowly rugose.

Head. Frontal furrows shallowly impressed. Antennal scape robust, slightly swollen apically. Ligula with sclerotized center area ellipsoid-convex with 2 apical setae. Mentum and submentum without accessory setae.

Prothorax. Pronotum (Fig. 4) slightly convex, slightly impressed along longitudinal center line, sides slightly reflexed. Proepipleura glabrous. Proepisterna glabrous. Anterior tibia with anterior surface longitudinally microstriate.

Pterothorax. Elytra moderately short, widened greatly at apical third, feeble costate. Humeri narrow, almost square. Costae and intervals smooth, pubescent laterad of ferrugineous stripes and near scutellum. Hind wings fully developed; metasternum fully developed.

Abdomen as described for genus (Erwin 1970).

Genitalia. Male (Fig. 1-3). Median lobe with plane of shaft not rotated from plane of basal bend. Basal bend short. Shaft slightly swollen medially. Apex of shaft asymmetric, rounded and bent dorsad. Ligule long, bilobed at apex. Virga (Fig. 1, 2). Female not dissected.

Variation: Specimens from Panama have testaceous palpi and legs, except for the infuscated femoral apicies and tibial bases. At the other end of the geographic range, in Argentina, specimens have nearly all black legs and infuscated palpi. The type, from Cayenne, has a condition intermediate to the above color extremes. Further, the pronotum in northern specimens is rather strongly constricted in the basal half, while Argentine specimens are much less constricted. The Cayenne specimen is also intermediate in this character state.

Flight: The wings are fully developed.

Etymology: Latin, *bi lineatus,* referring to the 2 elytral stripes.

Life history: All specimens seen were collected in June; none were teneral.

Distribution: The range of this species extends from Panama just north of the Canal Zone to northeastern Argentina.

Brachinus chalchihuiticue Erwin

Note: This species was previously recorded only from Mexico at localities in Guerrero, Nayarit, and Sinaloa.

Additional distribution: COSTA RICA: (Hamburg Farm at Reventazon) USNM; (Sixaola River) USNM. GUATEMALA: (Cayuaga) USNM. PANAMA: (Trinidad River) USNM.

Brachinus arboreus Chevrolat

Note: This species was previously recorded from Mexico at localities in Jalisco, Morelos, Sinaloa, and Vera Cruz, and from northernmost Honduras.

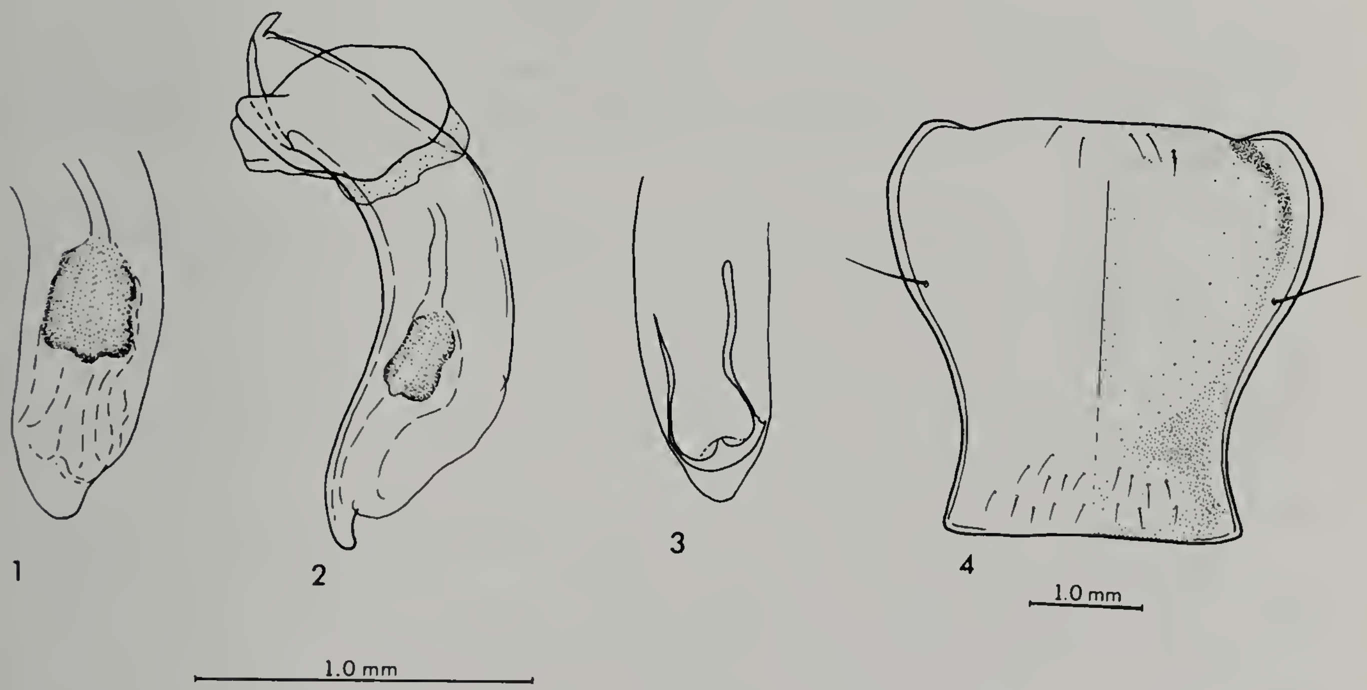

Fig. 1-4. *Brachinus bilineatus* Castelnau, Trinidad River, Panama: 1) ventral aspect, male genitalia, 2) lateral aspect, male genitalia, 3) dorsal aspect, male genitalia, 4) pronotum, dorsal aspect.

Additional distribution: COSTA RICA: (Bebedero, Guanacaste) USNM: (La Caja) USNM; (Taboga Agri. Expt. Sta.-swamp) USNM.

Brachinus costipennis Motschulsky

Note: This species was previously recorded from Utah and northern California south to Chiapas, Mexico.

Additional distribution: GUATEMALA: (Guatemala City) USNM.

Brachinus mexicanus Dejean

Note: Although previously recorded from Guatemala, no specific area was mentioned on labels I saw.

Additional distribution: GUATEMALA: (Guatemala City) USNM.

Pheropsophus aequinoctialis (Linné)

(See Erwin 1971 for discussion of names in the subtribe Pheropsophina)
Note: Previously I saw no specimens of this species from Central America or Mexico, although Bates (1883) recorded it from the Yucatan Peninsula in Mexico.

Additional distribution: COSTA RICA: (Hamburg Farm at Reventazon) USNM; (Palo Seco) USNM: (Turrialba) USNM. NICARAGUA: (Jinotepe) USNM. PANAMA-CANAL ZONE: (Boqueron River) USNM; (Darien) USNM.

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OBSERVATIONS ON THE BIOLOGY OF *HAPLORHYNCHITES AENEUS* (BOHEMAN) (COLEOPTERA: RHYNCHITIDAE)

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Abstract

The life history and habits of *Haplorhynchites aeneus* (Boheman) on *Helianthus divaricatus* L. in northern Illinois are discussed. Females cut stems below the flower heads, and eggs are deposited in the bases of the disk-flowers. Developing larvae feed on pollen and decaying tissue of the disk-flowers. Fourth instar larvae leave the flower head in October to enter the soil and overwinter; pupation occurs in the upper layers of the soil in July; and adults begin to emerge during the middle of July. Illustrations of all life stages and the host plant are included.

H. aeneus, previously in *Rhynchites* was originally described in 1829, and, although it is a relatively large and common weevil, little information (except host plants) has been published on its biology. It occurs throughout the eastern United States, westward to the continental divide, but is most numerous in the midwest.

Museum specimens associate it with many species in the sunflower tribe Heliantheae. The population involved in this study was associated with 3 species of *Helianthus: H. divaricatus* L. (woodland sunflower), *H. grosseserratus* Martens (sawtooth sunflower), and *H. annuus* L. (common sunflower), growing along railroad tracks in the same general area. *H. divaricatus* L. was the preferred host.

Cut heads of *Helianthus microcephalus* T. & G. were first noticed in southern Ohio in 1967. Adult weevils were collected on the cut heads but eggs and larvae were not found. The Illinois population was noticed in late September of 1970, and most of the observations and information were obtained in the summers of 1971 and 1972.

Male and female weevils were usually observed together on uncut flower heads shortly after their appearance in July (Fig. 1). Copulation occurs on these developing heads. After copulation, or even during copulation, the female weevils cut the stem with their mandibles ¼ to ½ inch below the developing flower head (Fig. 2). The cut is not complete, and the flower head remains attached in a hanging position for variable lengths of time (Fig. 3). Clusters of as many as 10 weevils have been found beneath a single hanging flower head at night and on cool days.

Males and females were observed chewing and inserting their rostra into cut and intact flower heads during late July. Oviposition was not observed although eggs were consistently found within the base of the disk-flowers of cut heads only (Fig. 4). The eggs hatch in about 1 week.

The first instar larvae feed on pollen within 1 disk-flower (Fig. 5). As the larvae grow to second and third instars, adjacent disk-flowers are consumed (Fig. 6). Occasionally as many as 3 larvae were found within a single flower

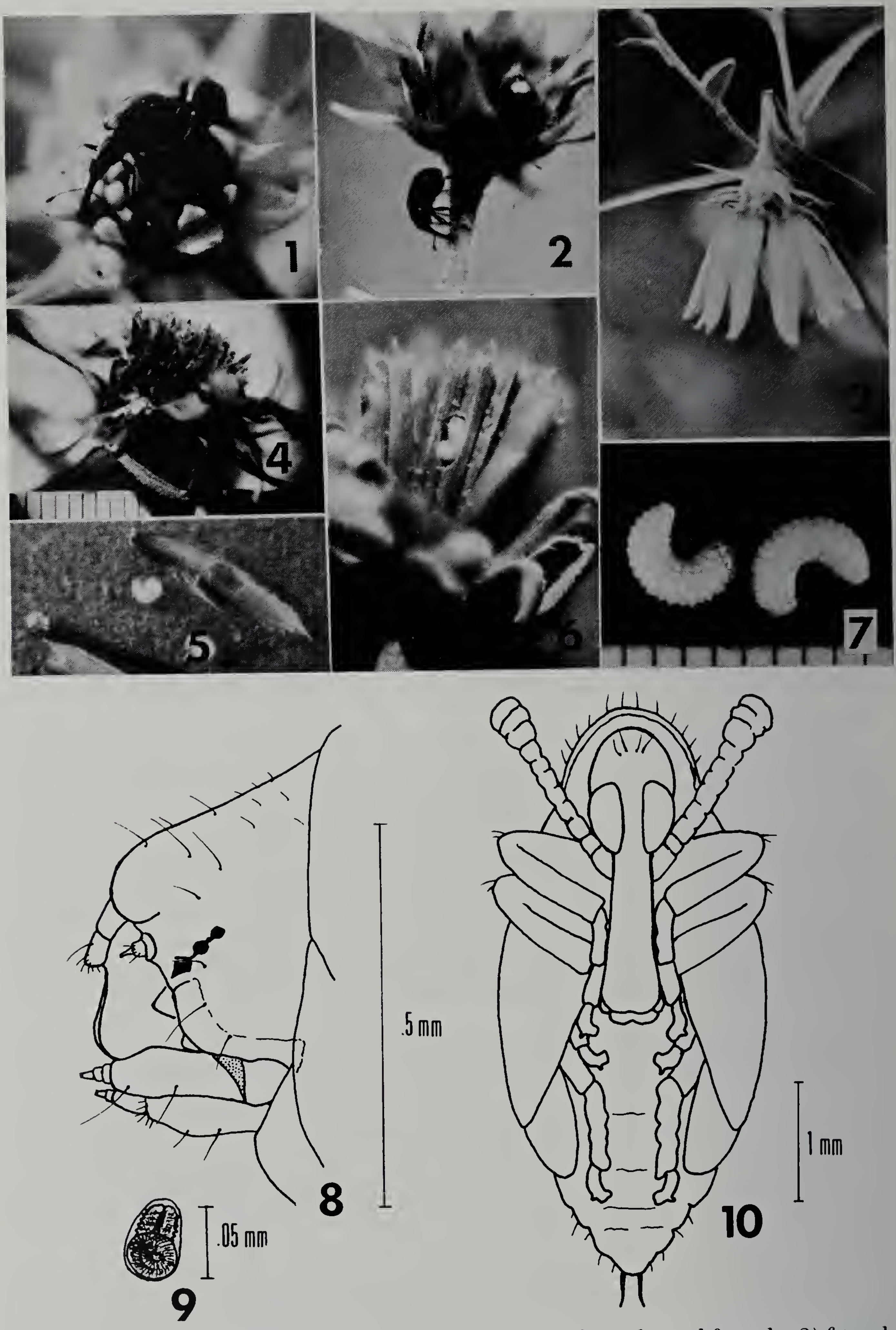

Fig. 1-2, 4-10: *Haplorhynchites aeneus:* 1) adult male and female, 2) female cutting stem of host plant, 4) egg, 5) 1st instar larva removed from disk-flower, 6) 2nd instar larvae in disk-flowers, 7) 4th instar larvae, 8) same, lateral view of head, 9) same, annular biforous prothoracic spiracle, 10) pupa, ventral view.

Fig. 3: Cut flower head of *Helianthus divaricatus.*

head. The larvae when approximately 5mm long (Figs. 7-9) leave the cut heads (most are on the ground by this time) and enter the soil to a depth of about 1 foot. A few larvae were still in the fallen heads on October 15, but none could be found during the first week of November.

In the spring and early summer larvae were found in the soil around the host plants. Pupae (Fig. 10) were found in dirt cells in and around the roots in the first week of July. Pupal duration was about 10 days. Time between larval instars was 20 to 30 days.

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BOOK REVIEW

American Entomologists by Arnold Mallis. 1971. Rutgers University Press, 30 College Ave., New Brunswick, New Jersey 08903. 549 p.; 211 Fig. Cloth, $15.00.

Although there are several articles containing biographies of American Entomologists, none is as extensive and as complete as this book. I'm sure that some would quarrel with the selections, but the 203 sketches cover most of the great deceased North American entomologists. The author must have spent thousands of hours of library research and voluminous correspondence in researching these exciting personalities. He has made a special attempt to discuss the men themselves, as well as their accomplishments.

The book is divided into 14 parts: 1) pioneer entomologists, 2) early state entomologists, 3) early federal entomologists, 4) early entomologists in Canada, 5) notable teachers, 6) notable Neuropterists, 7) notable Orthopterists, 8) notable Homopterists-Hemipterists, 9) notable Coleopterists, 10) notable Lepidopterists, 11) notable Hymenopterists, 12) notable Dipterists, 13) notable Arachnologists, 14) entomologists of divers interests.

In addition to Coleopterists treated in chapters on pioneer and early state entomologists (e.g., T. Say, T. W. Harris, etc.) the following are treated in Capt. 9: J. L. LeConte, G. H. Horn, E. A. Schwarz, H. Ulke, T. L. Casey, C. W. Leng, H. C. Fall, E. C. Van Dyke, W. S. Blatchley, F. E. Blaisdell, H. F. Wickham, and H. S. Barber.

The primary complaint I have is that the 549 pages are insufficient to cover the many other great names in such a diverse science. If this sounds like an endorsement for future volumes, it is! The author probably could put together another volume with the other sketches he must have accumulated during this book's preparation. I hope he will.—R. E. Woodruff

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THE GENUS *OZOCTENUS* PASCOE (COLEOPTERA, CURCULIONIDAE)

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Abstract

Ozoctenus vaurieae n. sp. (type-locality, Brazil, State of São Paulo, Caraguatatuba) is described from several localities in southeastern Brazil. The new species is compared to the 2 other known species of the genus, *Ozoctenus jubatus* Pascoe (from the Amazonian Region) and *Ozoctenus dufaui* Hustache (from Guadeloupe), and a key is presented.

While trying to interpret some structures of *Camarotus* (Attelabidae), in the course of a monographic work, one of us (Reichardt 1971:102) discovered that the species of a completely unrelated genus, *Ozoctenus* Pascoe, had the hind femora expanded into a serrate tooth similar to that of the front femora of *Camarotus.* We have since found similar structures in other unrelated weevils, and even in different families (e.g., the cerambycid genus *Plectromerus* LeConte and in some Bruchidae). In Bruchidae the structure is quite common, and apparently all intermediate situations between a simple and a serrate tooth are found. The function of the serrate tooth, if any, remains a puzzle. Its occurrence on different legs (in *Camarotus* and *Prionomerus* it appears on front legs; in all other cases seen it has developed on hind legs), and in quite distinct groups (though all considered as belonging into the Phytophagoidea), seems to indicate adaptation to some kind of common behavior, perhaps the grasping of edges of leaves.

Reichardt (1971:101, Fig. 1) has shown that in *Prionomerus* the serrate tooth is quite irregular and different from that of *Camarotus.* In the 3 species of *Ozoctenus* the serrate tooth is a very regular structure (Fig. 3), similar to that of *Camarotus,* including the presence of a curved seta between denticles. The sexual dimorphism, of the apical spines of the corresponding tibiae, is absent in *Ozoctenus.*

By scanning the material of *Ozoctenus* more closely, we concluded that the species at hand did not fit the descriptions of either *Ozoctenus jubatus* Pascoe, 1871 (type-species) or *Ozoctenus dufaui* Hustache, 1929. Through the kindness of Dr. R. T. Thompson, British Museum (Natural History), London, we received a paratype of each of the known species. It was disclosed that the species from southeastern Brazil is actually a distinct, undescribed species of the small genus.

Relationships of *Ozoctenus* within the Hylobiini seem rather difficult to establish. Marshall (1932) rearranged the whole group, placing the genus in the Orthorrhinina, it being the only New World representative of a subtribe which otherwise only includes *Orthorrhinus* Schoenherr, a genus widely distributed in Wallacea and Australia. The Orthorrhinina are distinguished from the other Hylobiini by the "front coxae separated" (Marshall 1932:346). We have compared *Ozoctenus* with *Heilipus* (Hylobiina), and could not see too much difference. Unfortunately no other Orthorrhinina were available for study, and thus we are unable to decide whether the current placement of *Ozoctenus* is correct. Marshall could hardly have been mistaken, since he based his studies on the British Museum collections, and must therefore have seen *Ozoctenus*.

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[1] Bolsista, Fundação de Amparo à Pesquisa do Estado de São Paulo.

The studied material belongs to the Museu de Zoologia, Universidade de São Paulo (MZSP) and the Departamento de Zoologia, Universidade Federal do Paraná, Curitiba (DZUP). One paratype each is being deposited in the American Museum of Natural History, New York (AMNH) and the British Museum (Natural History), London (BMNH).

We are indebted to R. T. Thompson for the loan of the paratypes. R. L. Araujo and U. R. Martins read and criticized the manuscript. Their help is gratefully acknowledged.

Ozoctenus vaurieae Reichardt & Vanin, NEW SPECIES

(Fig. 1-4)

Holotype male. BRAZIL, SÃO PAULO: Caraguatatuba, Reserva Florestal, 40 m, 2-IV-1962 (Martins, Reichardt & Silva) (MZSP).

Paratypes. BRAZIL, SÃO PAULO: same data as holotype (1 female, MZSP); same locality, II-1963 (F. Werner, Martins & Silva) (1 male, BMNH); Embu, 15-II-1946, 6-II-1972, 5-III-1972 (F. Lane) (2 males, 1 female, MZSP; 1 female, AMNH); Itanhaem, 1-5-V-1961 (U. Martins) (1 female, MZSP). MINAS GERAIS: Serra do Caraça, 1,380 m, XI-1961 (Kloss, Lenko, Martins, & Silva) (1 male, MZSP). ESPÍRITO SANTO: Linhares, Parque Nacional Sooretama, XI-1967 (F. M. Oliveira) (1 male, 1 female, DZUP; 1 female, MZSP). GOIÁS: Pirineus, 2-II-1962 (J. Bechyné) (1 female, MZSP).

MALE. Dark brown, head and prothorax nearly black; head with a few scattered, ochraceous scales on upper part of rostrum, between and above eyes; pronotum with brown scales, particularly dense on disc and on sides, and some more elongate scales along anterior margin; scutellum with dense cover of testaceous scales; elytral scales not as dark as on pronotum, more or less testaceous on disc, darker near base and on apical declivity, except for a transverse band of lighter scales in middle of declivity (in some specimens somewhat obscured); ventral parts of thorax and abdominal sternites with sparse, testaceous scales; femora and tibiae with more or less sparse, also testaceous scales; on the posterior, dentate femora, the scales are denser.

HEAD. Rostrum almost straight, only slightly longer than frons, very little widened towards apex, with antennal scrobes lateral and oblique, reaching lower margin of eyes; anterior surface rugose, the rugosity forming irregular, longitudinal ridges. Frons rugose; vertex microrugose. Eyes nearly circular, with coarse facets; separated from each other by about as much as eye width. PRONOTUM only slightly wider than long, widest slightly in front of middle; then abruptly narrowed and with almost parallel sides to front margin; from widest point little but regularly narrowed towards base; posterior margin curved toward scutellum in the middle. Median longitudinal keel only little prominent, extending from anterior margin to just beyond middle; edge of keel smooth, shiny and black. Ocular lobes faintly indicated. SCUTELLUM small, quadrangular, longer than wide. Elytra with nearly parallel sides, only slightly wider than pronotum, and a little widened behind the middle, and then more or less abruptly narrowed, forming an obtuse, rounded, pre-apical angle; posterior margin almost transverse; sutural angles rounded. Punctate-striate, the punctures widely spaced, each bearing a scale different from normal scales; punctures feebly visible on disc, deeper on sides; interstice I (sutural) with about 10 small, conic tubercles; III with an elongate tubercle near base and about 7 conical tubercles from second third towards apex; IV with 3-4 tubercles on declivity; V with more irregular and less developed tubercles; VI with fewer tubercles, those of the declivity better developed,

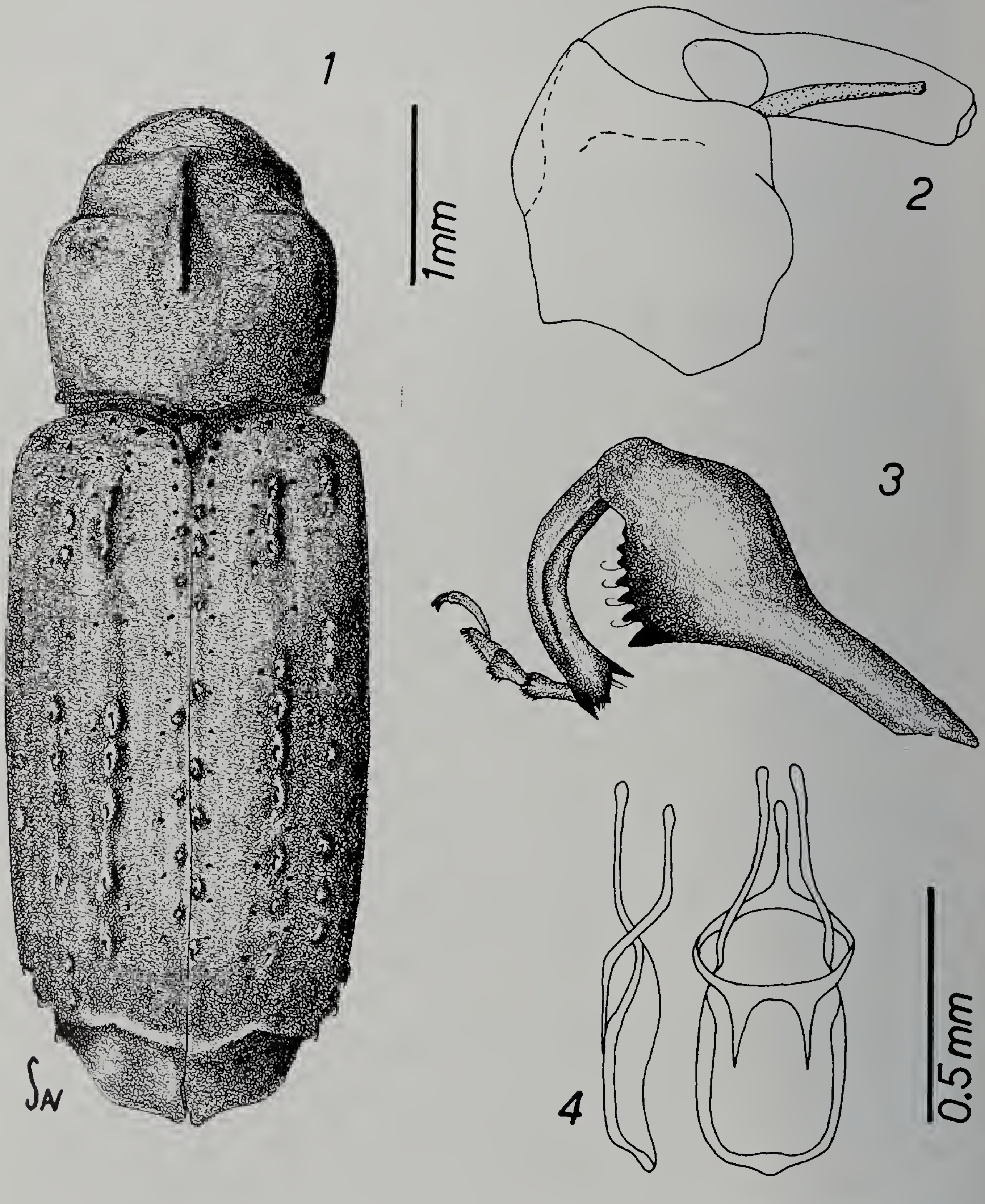
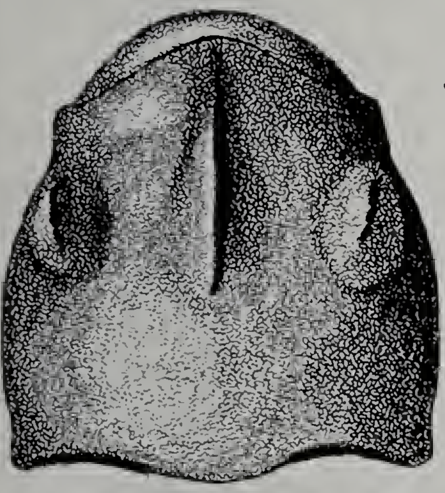


Fig. 1-4. *Ozoctenus vaurieae* n. sp., holotype: 1) dorsal view, 2) lateral view of head and pronotum, 3) hind leg, 4) male genitalia.

where they form a larger and irregular elevation together with the tubercles of IV and V. Apically each tubercle with a black, setiform, posteriorly bent scale. ABDOMEN: sternite I with median, longitudinal depression; II with 4 obtuse, conic tubercles placed in a transverse line. Suture between sternites I and II distinct. LEGS: femora clavate, anterior and middle ones with large, internal spine; posterior ones with larger spine, with internal margin finely dentate (6 to 7 denticles); anterior and median tibiae curved, with apical, unciform tooth; posterior ones more curved, external margin regularly curved, with 1 apical external unciform tooth and another, larger, pre-apical internal tooth. Tarsi normal.

FEMALE. Rostrum smooth, shiny, without longitudinal ridges and narrower than in male.

MEASUREMENTS: total length (pronotum and elytra), 3.1-5.1 (4.0) mm; width, 1.1-2.1 (1.4) mm.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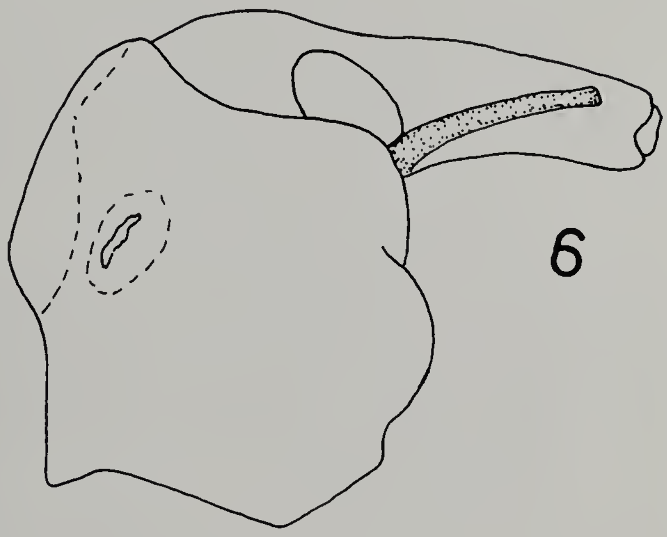
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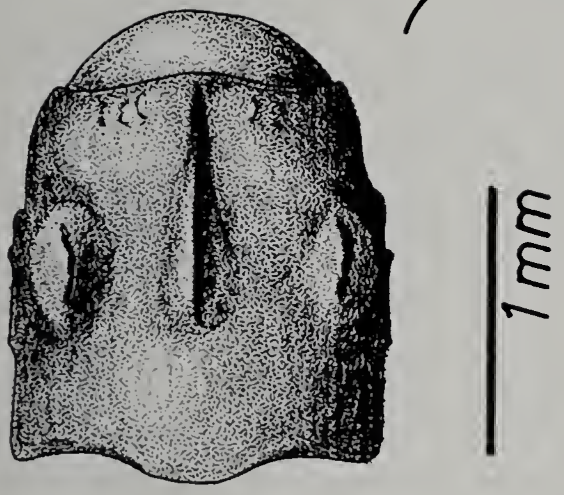
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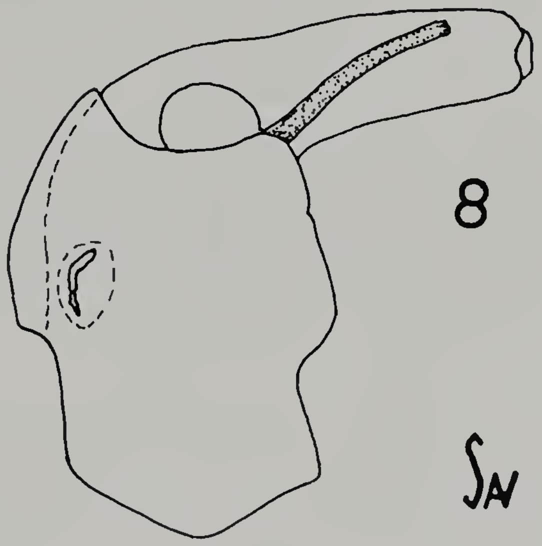
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Fig. 5-6. *Ozoctenus dufaui* Hustache, paratype: 5) dorsal view of pronotum, 6) lateral view of head and pronotum.

Fig. 7-8. *Ozoctenus jubatus* Pascoe, paratype: 7) dorsal view of pronotum, 8) lateral view of head and pronotum.

Discussion

This new species is readily distinguished from the 2 other known species of the genus by the pronotum, which lacks the 2 lateral tubercles present in *jubatus* (Fig. 7) and *dufaui* (Fig. 5). Furthermore the pronotum is slightly wider than long, while in *dufaui* it is about as long as wide, and in *jubatus* it is longer than wide. The pronotal keel is less evident in *Ozoctenus vaurieae*; besides, as in *jubatus,* the tubercles of interstice III do not form a continuous and elongate tubercle, typical of *dufaui.* In *vaurieae* abdominal sternite II bears 4 more or less well developed tubercles, while *jubatus* has the indication of only 2, and *dufaui* lacks tubercles.

Ozoctenus vaurieae is quite variable in size and coloration. Some specimens are very dark brown, while others tend to be much lighter, because of lighter colored scales.

We take pleasure in naming this species after Mrs. Patricia Vaurie, weevil taxonomist at the American Museum of Natural History.

Key to species of *Ozoctenus*

1. Pronotum with median longitudinal keel well developed from anterior margin to beyond middle, and 2 lateral elevations. Suture between abdominal sternites I and II poorly indicated, only visible laterally; surface of sternites not coarsely punctate, without sparse scales; sternite II without clearly indicated elevations 2

1′. Pronotum only with median longitudinal keel (Fig. 1). Suture between abdominal sternites I and II well indicated and deep; sternites coarsely punctate, each puncture with a single scale; sternite II with 4 conical tubercles in a transverse row. Brazil (Goiás, Espirito Santo, Minas Gerais and São Paulo) .... *vaurieae* n. sp.

2(1). Pronotal keel (in profile) abruptly ending behind middle (Fig. 8). III elytral interstice with an elongate tubercle near base and several small, dentiform and isolated tubercles posteriorly. Interstices IV-VII with dentiform tubercles similar to those of III on posterior third. Denticles of posterior femora as long as wide at base. Brazil (Amazonas) .... *jubatus* Pascoe

2′. Pronotal keel, in profile, smoothly and evenly ending behind middle (Fig. 6). III elytral interstice with irregular but continuous keel, only interrupted anteriorly. Interstices IV-VII without evident dentiform tubercles on posterior third. Denticles of posterior femora longer than wide at base. Guadeloupe .... *dufaui* Hustache

References

Marshall, G. 1932. Notes on the Hylobiinae (Col., Curc.). Ann. Mag. Nat. Hist. (10)9:341-355; 4 Fig.

Reichardt, H. 1971. The Camarotine weevils (Coleoptera, Attelabidae). Arq. Zool., S. Paulo, 20(2):97-189; 109 Fig.

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FIREFLY PARASITES AND PREDATORS[1]

James E. Lloyd[2]

Abstract

Fireflies (Coleoptera; Lampyridae) are parasitized by Diptera (Phoridae, Tachinidae), mites and nematodes. Predator literature is largely anecdotal and speculative—luminescence and chemicals might deter certain predators, and luminescence may attract others. Fireflies are distasteful to some lizards, birds, and mammals. Predators that possibly specialize on fireflies are certain birds (Caprimulgidae, Nyctibiidae), spiders (Lycosidae, Araneidae), certain anoles (Iquanidae) and frogs. Female *Photuris* spp. fireflies are specialized predators of luminescent male fireflies (*Photuris, Photinus, Pyractomena*).

Information on parasites and predators of fireflies is scattered throughout the literature and for the most part is anecdotal. Over the past several years I have collected these notes and anecdotes, reared parasites from fireflies, performed simple predator experiments, and accumulated anecdotes of my own. This paper gathers all of this information and is more historical than scientific; these notes, though interesting reading, unfortunately comprise the substance of scientific knowledge on the subject, a condition which clearly should be corrected. There are a number of reasons why such a compilation may be of value: firefly behavior is important taxonomically and the predators, and perhaps parasites too, have certainly had an influence on the evolution of mating signals and behavior; the literature, as we shall see, is replete with imagined "functions" of firefly luminescence—perhaps this will stimulate some investigation; attempts have been made to use fireflies for biological control (Bess, 1956; Clausen, 1940; Sweetman, 1958)—in a future control program these notes might provide clues to difficulties encountered in trying to understand the behavior and interactions of other species.

Parasites

Two species of dipterous parasites have been reared from fireflies. A tachinid, *Hyalomyodes triangulifer* (Loew), was reared from *Ellychnia corrusca* (L.) by Sabrosky and Braun (1970), from *Photinus obscurellus* LeC. (D. Oertel, pers. comm.) and I reared it from 3 species in 3 genera (Table 1). I have reared a phorid, *Apocephalus antennatus* Malloch, from 8 firefly species in 3 genera (Table 1). The species parasitized by the phorid are all luminescent as adults. The species parasitized by the tachinid, except *Photinus obscurellus,* are nonluminescent as adults. I found a dipterous (muscoid) maggot partly emerged from under the pronotum of a preserved female *Photinus ignitus* (luminescent species) from Long Island, N. Y. (Fig. 1) which may be a tachinid, but positive identification is not possible.

I observed the emergence of the last 2 of 4 phorids parasitizing a *Photinus macdermotti* female; both emerged from the posterior tip of her abdomen, the third took less than 2 min and the fourth began 1-2 min later and took 45 sec. Of 4 phorids (*Apocephalus* sp.) arrested in the process of leaving a *Pyrac-*

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[1] Spiders, fireflies, and parasites are deposited in the Florida State Collection of Arthropods, Gainesville. Some parasitic Diptera are deposited in the USNM, Washington.

[2] Dept. of Entomol. and Nematol., Univ. of Florida, Gainesville 32601; Univ. Michigan Biol. Sta., Pellston.

tomena borealis male (and found long after the firefly was pinned) 2 were emerging at the tip of the abdomen, and 2 emerged between the pronotum and the top of the head.

Two phorid adults, *Megaselia* sp., were found in a cage of firefly larvae that had been reared from eggs that were laid in the laboratory by a captive *Photuris* sp. female. Neither their origin, nor the significance of their presence there is known.

Mites are frequently found on firefly larvae and adults: McDermott (1960) noted one on a preserved adult of a *Pyractonema* sp. (not *Pyractomena*) and on living larvae of *Micronaspis floridana* Green (1954). Schwalb (1960) found them on adults and larvae of *Lampyris noctiluca* L. I have found them on adults of *Pyropyga decipiens* (Harris), *Pyropyga minuta* LeC., *Photinus pyralis* (L.), *Photuris lucicrescens* Barber, *Photuris* spp., *Photinus ignitus* (Fig. 2), and others.

Schwalb (1960) reported nematodes in the heads and necks of *Lampyris noctiluca* larvae, and I found them in larval *Pyractomena limbicollis* Green—perhaps ingested with the aquatic snails which I fed them.

Fungi sometimes infect firefly cultures: *Beauveria bassiana* (Bols) (Schwalb, 1960) and *Trichoderma* sp., *Rhyopus* sp., and *Penicillum* sp. (D. Minnick, unpub. ms.).

PREDATORS

Chemical defense: Firefly odors and tastes have been mentioned in the literature on numerous occasions, sometimes specifically in relation to predators: birds don't feed upon *Cratomorphus* sp. "owing to the disagreeable odour, resembling that of phosphorus . . ." (Hudson, 1922); the odor of a firefly made a dog sneeze (Ridley, 1934); "*Luciola* on being crushed emits an unpleasant flavor, but its taste is not at all bitter" (Macloskie, 1885); a crushed *Luciola* sp. "gives out a disagreeable cabbage-like smell, and perhaps this is sufficient to render it inedible to bats or other nocturnal animals. An acrid taste they certainly do not possess" (Packard, 1896); "Between the light which they give and the sticky exudation and unpleasant odour of most species, it seems hardly likely that they would prove a tempting morsel to insectivorous creatures" (McDermott, 1910). Other comments on odor and taste are: a collection of dried *Pyractonema* spp. smelled like *Photinus pyralis* to McDermott (1960); the smell of *Pyractomena borealis* differs from that of *Photinus pyralis* (McDermott, 1917); "I fancied I perceived an odour of the common puff-ball fungus . . ." (Swinton, 1880); a faint musky odor (Ridley, 1934); a peculiar odor (King, 1878); an odor "may be of value in defense, and in making the producing organism unpalatable to its enemies" (Crawford, 1934); "the firefly has a very bitter taste . . ." (S. Watase, see Hearn, 1902); the taste of *P. pyralis* is "slightly astringent but not particularly harsh to a human" (Sexton, 1964); and a nauseating odor when 10,000 - 20,000 are confined in a room (Kiichiro, 1961). I have noticed, with the various species, many of the odors described above, especially the disagreeable cabbage-like odor of the New Guinea firefly *Luciola obsoleta* (Olivier) and the Guadalcanal species *Luciola salomonis limbatipennis* Pic and *Luciola wolfi* Olivier.: some *Photuris* species smell quite plant-like. Many species readily exude fluid from their coxal joints, pronota, and elytra when they are handled roughly; this is

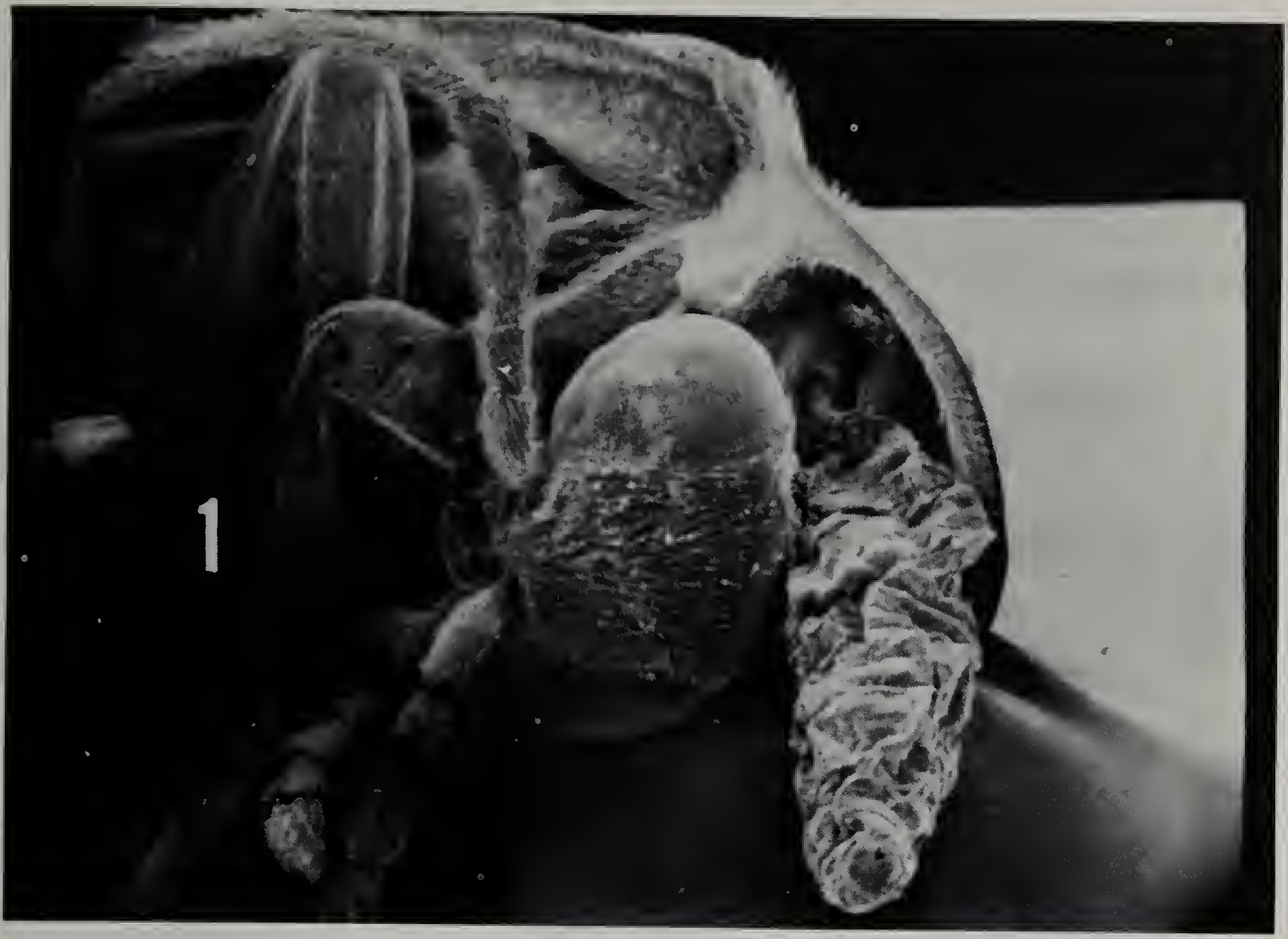

Fig. 1. Muscoid (tachinid?) parasite, now dried and wrinkled from preparation for stereoscan photography, arrested as it emerged from between the head and pronotum of a female *Photinus ignitus* firefly (26X).

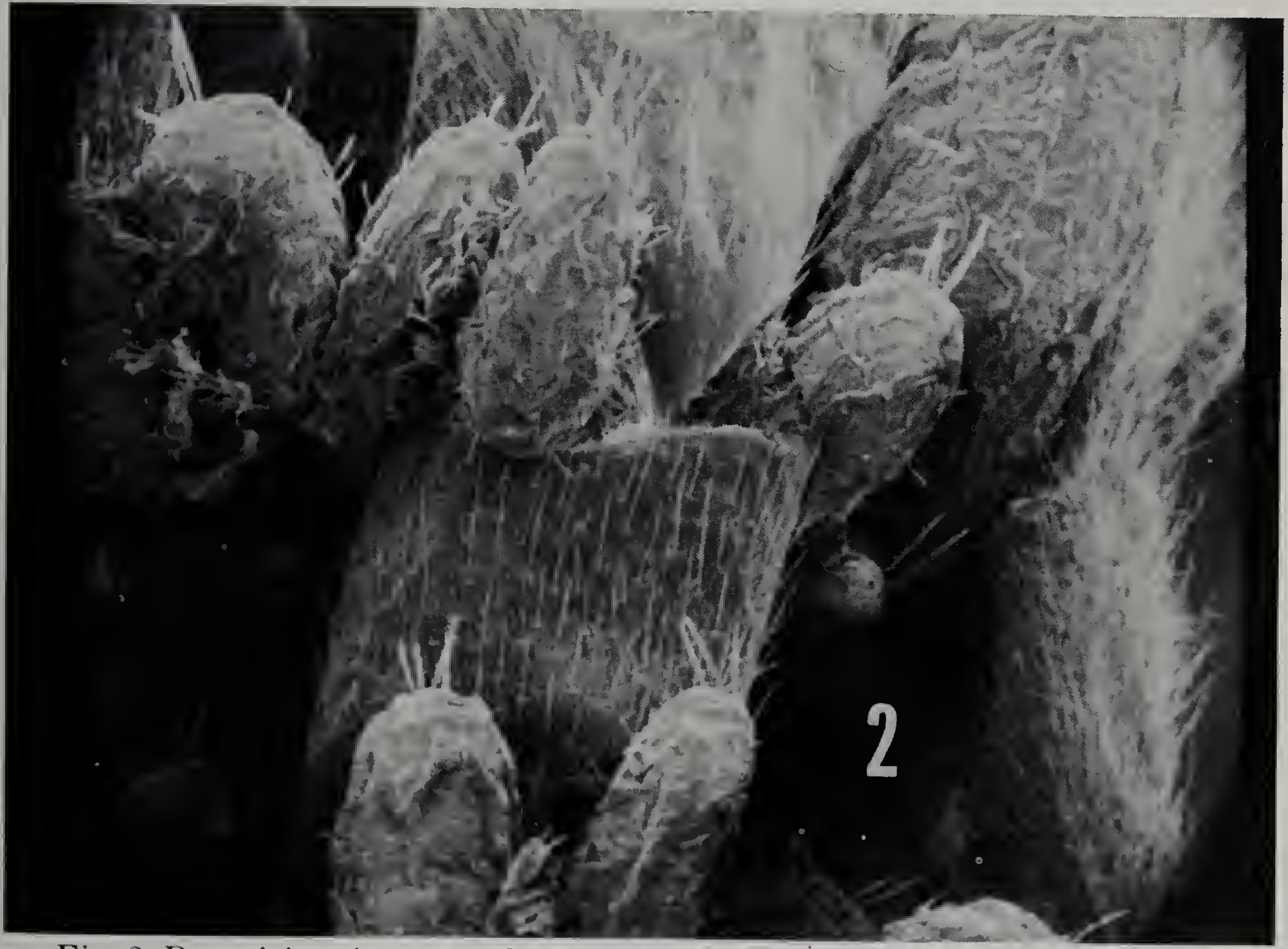

Fig. 2. Parasitic mites attached between the abdominal tergites of a female *P. ignitus* (82X). Eleven mites are visible in this scanning electron micrograph; at least 19 were present.

probably protective (Williams, 1917). W. Kloft (pers. comm.) found that the fluid emitted from a pore in the metathoracic tergite of *Photuris* "D", when the beetle is roughly handled, is haemolymph. He injected radioactive phosphorus into the haemocoel through an intersegmental membrane near the posterior tip of the abdomen. At 7 min. after the injection, radioactivity of the exuded fluid was 4-6 cpm (counts per minute) above background, and at 8 min. it was 185 cpm above background. The rapid appearance of radioactive fluid indicates that the fluid is haemolymph and not a glandular product. Other comments relating to chemical defenses are below.

Luminescent caveat: There have been several suggestions, not necessarily independent, that the luminescence of juvenile and adult fireflies warn predators of the distastefulness of their prospective prey: a toad did not take a glowing firefly offered to it (Schwalb, 1960); "It may also afford the insect a measure of protection for it has been observed that the Carabid beetles leave the fireflies alone" (Guenther, 1931); luminescence possibly warns of inedibility (S. Watase, in Hearn, 1902; Blair, 1915, 1924): "In the case of nocturnal species, the emission of light may serve as a 'warning signal' to bats and nocturnal birds but there is little to support this view" (Maxwell-Lefroy, 1909); "The winged species may also utilize this power to . . . betray their presence to the carnivorous species . . ." (King, 1878); larval lights warn predators (Kaiser, see Harvey, 1952; Hess, 1920; Balduf, 1935); "the flashing light provides . . . a recognition character, so that night-feeding birds and bats avoid attacking these insects" (Dillon, 1967); "May not the light then [if "Lampyridae are distasteful to many insectivora"] serve . . . as a warning of their offensiveness to creatures that would devour them?" (Bowles, 1882); and if the larval bite is poisonous or if fireflies "are disagreeable to the taste the light would of course serve as a danger signal to protect its givers from attack"

TABLE 1. FIREFLY HOSTS OF DIPTERA PARASITES

Dipterous Parasite Firefly Host, Sex	No./Host	Date Left Host	Pupation (days)	Locality
Apocephalus antennatus				
Photuris congener LeC., m	3	27/IV/67	9	Gainesville, Florida
Photuris congener, m	5	4/IV/67	-	Gainesville, Florida
Photuris congener, m	2	3/V/68	15-16	Gainesville, Florida
Photuris sp. *A*, m	2	30/IV/67	22	Gainesville, Florida
Photinus ignitus Fall, f	2	17/VII/64	-	Chenango Forks, New York
Photinus macdermotti Lloyd, f	4	22/VI/68	-	Cockeysville, Maryland
Photinus obscurellus LeC., f	6	15/VI/68	14-15	Oneida, New York
Photinus curtatus X *marginellus,* f	1	21/VII/64	-	Oneida, New York
Photinus consanguineus LeC., m	2	-	-	-
Pyractomena borealis (Randall), m	4	28/III/68	-	Gainesville, Florida
Hyalomyodes triangulifer				
Photinus indictus (LeC.), f	1	15/VII/71	13	Pellston, Michigan
Photinus indictus, f	1	10-12/VII/72	12-14	Pellston, Michigan
Lucidota atra (G. Olivier), f	1	3/VII/71	12-13	Pellston, Michigan
Pyropyga nigricans (Say), f	1	30/VI/71	10+	Pellston, Michigan
Ellychnia corrusca (L.), -	-3-	lab (in lit)	12-13	Beltsville, Maryland
Photinus obscurellus LeC(n = 4)	1	4/VII/72	10(n = 1)	Woods Hole, Massachusetts

TABLE 2. SPIDER PREDATORS OF FIREFLIES

Firefly Prey, Sex	Spider, Stage, Sex	Locality	Date
Photinus brimleyi, m	*Neoscona arabesca* (Walck.), imm. f	Crailhope, Kentucky	21-VII-63
Photinus brimleyi, m	*Neoscona arabesca*, imm. m	Crailhope, Kentucky	18-VII-63
Photinus brimleyi, m	*Neoscona arabesca*, imm. f	Standing Stone St. Park, Tennessee	5-VII-64
Photinus brimleyi, m	*Neoscona arabesca*, imm. -	Crailhope, Kentucky	8-VII-64
Photinus brimleyi, m	*Verrucosa arenata* (Walck.), imm. f	Crailhope, Kentucky	22-VII-63
Photinus brimleyi, m	*Verrucosa arenata*, sub.ad.f	Crailhope, Kentucky	22-VII-63
Photinus brimleyi, m	*Verrucosa arenata*, ad. f	Crailhope, Kentucky	21-VII-63
Photinus brimleyi, m	*Agelenopsis* sp., imm. f	Crailhope, Kentucky	21-VII-63
Photinus brimleyi, m	*Araneus marmoreus* Clerck, imm. -	Crailhope, Kentucky	22-VII-63
Photinus brimleyi, m	*Eustala anastera* (Walck.), ad. f	Crailhope, Kentucky	22-VII-63
Photinus brimleyi, m	*Micrathena sagittata* (Walck.), ad. f	Crailhope, Kentucky	21-VII-63
Photinus brimleyi, m	*Ummida audouini* (Lucas), ad. f	Standing Stone St. Park, Tennessee	5-VII-64
Photinus collustrans LeC., m	*Acanthepeira venusta* (Banks), ad. f	Gainesville, Florida	5-V-64
Photinus collustrans LeC., m	Lycosidae (not captured)	Gainesville, Florida	19-V-64
Photinus curtatus Green, f	*Neoscona arabesca*, ad. f	Brisban, New York	3-VIII-63
Photinus curtatus X *marginellus*, f	*Neoscona arabesca*, ad. f	Oneida, New York	3-VII-63
Photinus curtatus X *marginellus*, 5 m	*Neoscona arabesca*, ad. f	Oneida, New York	3-VIII-63
Photinus granulatus, m	(ground nesting spider with web over hole)	Wichita, Kansas	27-VI-64
Photinus marginellus, m	*Neoscona arabesca*, ad. f	Greene, New York	21-VII-64
Photinus marginellus, m	*Neoscona arabesca*, ad. f	Chenango Forks, New York	18-VII-64
Photinus marginellus, m	*Neoscona arabesca*, ad. f	Chenango Forks, New York	18-VII-64
Photinus marginellus, m	*Neoscona arabesca*, ad. f	Chenango Forks, New York	18-VII-64
Photinus marginellus, m	*Neoscona arabesca*, ad. f	Greene, New York	22-VII-64
Photinus marginellus, m	*Neoscona arabesca*, ad. f	Greene, New York	18-VII-64
Photinus marginellus, m	*Neoscona arabesca*, ad. f	Ithaca, New York	2-VIII-63
Photinus marginellus, 2m	in web	Chenango Forks, New York	17-VII-64
Photinus obscurellus, m	*Araneus* sp. (probably *cornutus*), imm. f	Oneida, New York	8-VI-64
Photinus pyralis, m	*Neoscona arabesca*, imm. f	Carter Cave, Kentucky	17-VII-63
Photinus pyralis, f	*Enoplognatha marmorata* (Hentz), ad. f	Crailhope, Kentucky	6-VII-64
Photinus pyralis, m	*Acanthepeira stellata* (Walck.), ad. m	Wellington, Kansas	21-VI-64
Photinus sabulosus, m	*Neoscona arabesca*, ad. f	Chenango Forks, New York	17-VII-64
Photinus sabulosus, m	*Neoscona arabesca*, imm. f	Ithaca, New York	2-VII-63
Photinus scintillans, m	*Neoscona arabesca*, imm. f	New Brunswick, New Jersey	7-VII-63
Photinus tenuicincutus, m	*Neoscona arabesca*, imm. f	Fayetteville, Arkansas	30-VI-64
Photuris congener, 4m	seized by lycosid	Gainesville, Florida	14-IV-67
Photuris sp. *A*, m	seized by lycosid	Gainesville, Florida	26-IV-71
Photuris sp., m	*Acanthepeira stellata*, ad. f	Hart Co., Kentucky	17-VII-64
Photuris sp., m	*Neoscona arabesca*, ad. f	Cortland, New York	12-VII-63
Micronaspis floridana Green, f	lycosid	Cedar Key, Florida	12-V-68

(Seaman, 1891). Kirkpatrick (1966: 228), with little data and curious induction, concluded that a defensive function "appears to be the most probable explanation especially since these insects are said to be distasteful." Hudson (1922) thought that the light was not a warning, "That the firefly should have become possessed of so elaborate a machinery, producing incidentally such splendid results, merely as a protection against one set of enemies for a portion only of the period during which they are active, is altogether incredible."

Luminescent bogy: Other workers suggested that the light "frightened," i.e., elicited flight responses in, predators (and others); "the light-producing power . . . [is] for frightening such nocturnal enemies as bats" (Macloskie, 1885); predators are supposed to be frightened by the glowing fireflies that the weaver bird places on its nest (see Harvey, 1952); "*Photuris* larvae were so abundant and so brilliant on the road from Washington to Great Falls as to frighten a pair of spirited horses" (Seaman, 1891); a riding "horse plunged and snorted with alarm" at swarms of fireflies along an Argentinian stream, and raptoral insects are "scared" by firefly light (Hudson, 1922); "three rats on a roof rafter . . . scampered off" (Severn, 1881); a gecko turned and fled from a firefly that flashed (Shelford, 1916; Ridley, 1934); and a chicken fled at the flash of a firefly (McDermott, 1910). When the light of *Phosphaenus hemipterus* Geof. is "not visible a little irritation will render it so. This would make it probable that the light, at least in the male . . . [is used] as a means of frightening its enemies, and warding off danger." This is also probably the case in males of *Lampyris noctiluca* (Jenner, 1883). However, Vogel and Knauer observed that toads, frogs, bats, and spiders are not "frightened" by luminescence (see Schwalb, 1960).

Others have simply noted that fireflies turn on their lanterns when stimulated: *Pyractomena ecostata* (LeC.) adults turn on their light when disturbed (Wenzell, 1896); some larvae shine more brightly if disturbed or "alarmed" (Williams, 1917; Swinton, 1880; McDermott, 1958); adult males of *Pleotomus nigripennis* LeC. glow when disturbed (Sleeper, 1969).

Luminescent target: "While it is supposed by some, that the light of the wingless beetle is bestowed for her protection, to scare away her hungry foes, the nightingale and other birds of night; it is opined by others, that the insect's gift of brilliance . . . is the very mean of her destruction, the very lure and light by which her biped foes are assisted to discover and devour her" (Domestica, 1851:171); "that it is a warning to enemies seems hardly probable, for most small animals, whether aquatic or terrestrial, are attracted rather than repelled by light" (Annandale, 1900); "It guides their enemies—the night hawk and the 'whip-poor-will,' the bat and the owl" (Reid, 1899); "A frog, however, would not be intimidated by their light, which would only draw his attention to his prey" (Guenther, 1931); the light makes larvae and pupae "conspicuous to the eyes of insectivorous birds and other animals" (Seaman, 1891); and larval light "would seem to attract the attention of possible predators such as snakes and skunks" (McDermott, 1958). "Mr. Rennie, by way of disproving Mr. Knapp's theory respecting their dimming their light to escape from birds, positively states that they never extinguish it when alarmed or seized" (Fennell, 1835). "When the nymph is in full glory, she has the power of dimming her lamps, if disturbed by an unwelcome visitor, but can soon rekindle them when her fears are over" (Main, 1834). Aquatic larvae dim their lights when the water is disturbed (Annandale, 1900). "I was told a few days ago of a cat which used to search for and eat glow-worms. It was suggested that she took them for *lights*" (Henslow, 1879). "In Jamaica, in some seasons of the year, the fire-flies are seen in the evenings in great abundance. When they settle on the ground, the bull-frog greedily devours them; which seems to have given origin to a curious, though cruel, method of destroying these animals: if red-hot pieces of charcoal be thrown towards them in the dusk of the evening, they leap at them, and hastily swallowing them, are burnt to death" (Darwin, 1791, part II, Canto IV:145). It has been suggested that the flash evolved because the glow attracted predators (Harvey, 1952; Lloyd, 1966). L. Chadwick (pers. comm.) noted that bats on Dominica in the Caribbean dived toward a glowing cigarette each time it was puffed upon and made to glow brightly. Once while I was tape recording the flashes of a firefly female in a glass cage, a frog crashed into the cage; a haiku by Kashi observes, "Drawn by the light of the firefly, swims the frog" (Kiichiro, 1961); the 17th century naturalist John Banister noted, "I have seen our Froggs in an Evening (perhaps mistaking them for fireflies or glow) [Banister's paren, JEL] take in little live coals as greedily as Chickens peck up corn" (Ewan and Ewan, 1970, p. 296).

Other defense: It has also been suggested that the colors and color patterns of fireflies warn predators of unpalatability, that fireflies are involved in mimicry complexes including roaches, soldier beetles, moths, etc. (Belt, 1928; Jones, 1932; McDermott, 1958, 1961; Harvey, 1952, p. 403), and that luminescent elaterid beetles mimic lampyrids and derive protection (A. R. Wallace, see Harvey, 1956). Sexton (1960) manufactured artificial Batesian mimics of *Photinus pyralis* by gluing prothoraces and elytra from these fireflies on adult tenebrionid beetles: "When tested together with unmarked *Photinus,* only the mimics marked with both the prothorax and elytra escape some predation [by the green anole, *Anolis carolinensis*]; when tested together with unmarked *Tenebrio* [*molitor* L.], the mimics marked with elytra as well as those marked with both the elytra and prothorax escape some predation." In another study (1964) he found that "The anoles tended to capture more individuals of unicoloured species of insects than polycoloured species [including *P. pyralis*], whether or not the latter were distasteful or other wise obnoxious". Okada (1928) identified, as defensive organs on *Luciola* larvae, "a row of peculiar forked organs which project outwards further than the gills."

Vertebrate predators: There are several observations of fireflies being eaten or rejected by vertebrates. Monkeys reject fireflies (Belt, 1928), and the bat *Selysius bechsteini* rejected nonglowing fireflies if not mixed with mealworms, and if mixed they would spit them out (Schwalb, 1960). On 2 occasions when I was attracting flying male fireflies to a penlight, bats flew a few feet over my head through what I believed to be the approximate position of the fireflies, and the fireflies did not flash again. In Jahore, West Maylasia, bats attack fireflies that are flying toward (joining) trees with aggregations of fireflies flashing in synchrony (I. Polunin, pers. comm.). When a group of synchronizing fireflies was attracted from a firefly tree to a handheld bar of synchronously-flashing, artificial lights (ca 30 ft. from the tree), bats abruptly moved in and attacked them (F. Hanson, pers. comm.).

Ducks eat firefly larvae along with shellfish (Kiichiro, 1961); fireflies "hide themselves by day; as then their enemies (some of the warblers, it is supposed) are on the alert" (Main, 1834); "my fowls would not touch them" (Belt, 1928); birds rejected *Photuris pennsylvanica*[3] (McDermott, 1958); and on an edibility scale from 00 (inedible) to 100 (completely edible), birds (which species of the several observed not given) rated *Photinus consanguineus*[3] 00 and *Photuris pennsylvanica*[3] 12.7 (Jones, 1932).

The most interesting note on bird predation is given by Johnson (1937) and concerns the Trinidadian common potoo or poor-me-one, (*Nyctibius griseus*; Nyctibiidae) and fireflies identified as *Elyta* (no such genus known). "I sometimes observed the birds hunting for large fire-flies above the tree-tops in the moonlight. They always did this from a perch, to which they returned like a flycatcher. Since the beginning of April, after dusk the forest was alive with large fireflies (*Elyta*), which set up great dronings in the tree-tops. As 'Poor-me-one' is fond of these insects, it seemed rather that the nesting season would be when they were plentiful, which is in April, May, and June."

Birds of a closely related family (Caprimulgidae) were involved in 2 other interesting observations: "The food of Merrill's Parauque [*Nyctidromus albicollis*], like that of the rest of the Caprimulgidae consists mainly of night-flying insects, such as moths, beetles, etc. The crop of a specimen shot by Mr. H. P. Attwater, near Rockport, Texas, was filled with fireflies, *Photinus pyralis*?" (Bendire, 1895, p. 162). "F. H. Herrick (1901) writes of a Nighthawk [*Chordeiles minor*] that had been feeding on fireflies; the wide open mouth of an adult observed feeding its young was brilliantly illuminated like a spacious apartment all aglow with electricity" (Bent, 1964a, p. 226).

Analyses of bird stomachs have revealed other avian predators: "Fireflies, which are predaceous both in the larval and adult stage, are constantly fed upon by grosbeaks [rose-breasted, *Pheucticus ludovicianus*]. These insects are supposed to be excellent examples of protected species, having the power of secreting nauseous juices, while the 'fire' is supposed to act as a warning signal and certify the bearer's identity to its enemies. It is said that some birds refuse them. However, since 28 rose-breasted grosbeaks [of 176] fed upon them and 6 to 12 of the beetles were found in single stomachs, they must be relished by this species at least" (McAtee, 1908, p 44). McAtee listed 6 species of Lampyridae, 4 of which are now placed in Cantharidae; the remaining 2 species were *Ellychnia corrusca* and *Photinus pyralis*. Beal (1912) examined stomach contents of 100 Acadian flycatchers (*Empidonax virescens*) from 14 states and found *Photinus scintillans*[3] in one; Stoddard (1931) found *Photuris* sp. in one stomach and an unidentified firefly in one stomach (1659 examined) of the Bobwhite (*Colinus virginianus*). Wetmore (1961) examined stomach contents of Puerto Rican birds and found that: 3 Parula warblers (*Parula americana*) had fed upon *Photinus* sp. (*Robopus* sp.) and one upon *Photinus* (now *Robopus*) *vittatus* (61 examined, p 108); one cave swallow (*Petrochelidon fulva*) (of 36, p 87) had eaten *R. vittatus*; one Puerto Rican vireo (*Vireo latimeri*) (of 43, p 96) had eaten *Photinus* sp. (*Robopus* sp.); 3 yellow warblers (*Dendroica petechia*) (of 63, p 106) had eaten *R. vittatus* and 2 had eaten *Photinus* (now *Robopus*) *glaucus* (probably *Robopus dubiosus* (Leng and Mutchler), see Wolcott, 1948); 3 yellow-shouldered blackbirds (*Agelaius xanthomus*) (of 55, p 114) had eaten *R. glaucus* (*R. dubiosus*); and one black-cowled oriole (*Icterus dominicensis*) (of 71, p 116) had eaten *R. glaucus* (*R. dubiosus*).

Other records probably involve soldier beetles (Cantharidae) since they were formerly included in Lampyridae. Such "Lampyridae" were found in the stomachs of: 3 half-grown nestlings of the ovenbird (*Seiurus aurocapillus*) (Judd, 1900, p 416); western bluebirds (*Sialia mexicana*), ruby-crowned kinglets (*Regulus calendula*), and western golden-crowned kinglets (*Regulus satrapa*) (Beal, 1970:18, 100); horned larks (McAtee, 1905:35); 5 Bicknell's thrushes (*Hylocichla minima*) on their breeding ground (Bent, 1964:208); and of robins (*Turdus migratorius*)—"Larvae of the Lampyridae or fireflies, which live in the ground and so fall easy prey to the robin, were found in several stomachs to the extent of upward of a hundred in each" (Beal, 1915:6).

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[3] Species identifications incorrect or doubtful; *P. pennsylvanica* could have been any of several *Photuris* species; *P. consanguineus* probably *P. ignitus*; *P. scintillans* probably *P. marginellus*.

Another study, in which the stomachs of 698 Maryland birds were examined (year 'round, 7 years), found soldier beetles but not fireflies-—"Another useful predaceous beetle of the same family, having a similarly repulsive taste, is a firefly, *Photinus*. In June it sometimes, even during daylight, outnumbered the soldier-beetle, [*Chauliognathus pennsylvanicus*] but it was never found in stomachs . . ." (Judd, 1902:37).

Snakes have been suggested as predators of fireflies (Harvey, 1952; McDermott, 1958); Hensoldt (1890) described, in a test of Victorian credulity, the capture of fireflies by a cobra using a glowing stone, the cobra stone, thus "documenting" an Indian legend; Zahl (1962) observed that lizards ate fireflies then spat them out; and a house lizard catching insects on the ceiling would not eat fireflies (Travers, 1924).

In Puerto Rico *Callopisma borencona* Leng and Mutchler is eaten by lizards, *R. vittatus* is eaten by *Anolis cristatellus, R. dubiosus* by *Anolis evermanni* and *Anolis krugii,* and *Robopus roseicollis* Motsch. is "an appreciable item in the food of *A. evermanni* and *A. cristatellus*" (Wolcott, 1948). Sexton (1960) found that *Photinus pyralis* was rejected by the lizards *Anolis carolinensis, Sceloporus undulatus,* and *Eumeces fasciatus,* and 2 species of Venezuelan turtles, *Kinosternon scorpioides* and *Testudo denticulata.* Hungry anoles (i.e., anoles on low rations) are more likely to accept *Photinus pyralis* than lizards on higher rations (Sexton et al, 1966).

I have fed fireflies to 3 species of lizards: the green anole (*A. carolinensis,* 2 specimens), the fence lizard (*S. undulatus,* 4 specimens), and the broad-headed skink (*Eumeces laticeps,* 3 specimens). Fireflies, and the mealworms and crickets used with them, were presented in various ways since the lizards learned and were influenced by repeated test protocols. Prey was dropped into the cages, presented on long forceps, or "under glass" (on a platform while under a clear plastic dish that could be lifted away by a long handle). The latter delayed the lizards' attacks, and they would rapidly circle and poke at the dish, presumably having then a longer period to observe the prey before they could strike.

All lizards rejected *Photinus umbratus* LeC. When seized it was spat out immediately; then the lizard wiped its snout with its forelegs, opened and closed its mouth, and pushed its snout through the sand on the floor of the cage. Similar behavior was observed in *A. carolinensis* by Sexton (1964), in response to *P. pyralis.* Other *Photinus (P. consimilis* complex and *P. consanguineus*) were rejected with similar vigor in the few tests in which they were used. Fireflies frequently survived attack even though seized and roughly spat or thrown several inches. *Photuris* sp. "A" was usually rejected but under certain circumstances (see below) was swallowed.

Fireflies were presented simultaneously "under glass" with mealworms and crickets and with other fireflies of the same and different species. Crickets were also presented with other crickets and mealworms. In these tests the lizards grabbed the edible species, sometimes quite "delicately" around and over the backs of fireflies. Once, as a mealworm was seized, the antenna of a *Photinus* was also grabbed. The lizard rubbed the firefly away, then rubbed its snout with its forelegs, then swallowed the mealworm. It was in choice tests such as this that *Photuris* fireflies were grabbed and swallowed. On 2 occasions, within seconds of swallowing a cricket, a lizard grabbed and ate the firefly.

Tests performed on lizards, immediately after they were captured, suggested that they had experienced fireflies in nature. A female skink began eating maintenance prey (mealworms, crickets) 4 days after capture but

TABLE 3. FIREFLY PREDATORS OF FIREFLIES

FIREFLY PREDATOR (FEMALES)	FIREFLY PREY (MALES)	SOURCE[c]
Photuris jamaicensis Olivier[d]	*Photinus* sp.	Worthy Park, Jamaica T. Walker
Photuris lucicrescens Barber	*Photinus sabulosus* Green	Hancock, Maryland[c]
Photuris pennsylvanica[a]	*Photinus consanguineus*[a]	Hess, 1920
Photuris pennsylvanica[a]	*Photinus marginellus*[a]	Hess, 1920
Photuris pennsylvanica[a]	*Photuris pennsylvanica*[a]	Williams, 1917
Photuris pennsylvanica[a]	*Photinus scintillans*[a]	Williams, 1917; Hess, 1920
Photuris versicolor complex	*Photinus collustrans* LeC.	Gainesville, Florida
Photuris versicolor complex (n = 4)	*Photuris congener*	Gainesville, Florida
Photuris versicolor complex[d]	*Photuris congener*	Gainesville, Florida
Photuris versicolor complex (n = 2)	*Photinus tanytoxus* Lloyd	Gainesville, Florida
Photuris versicolor complex	*Photinus macdermotti*	Lloyd, 1965
Photuris versicolor complex	*Photuris* sp. A.	Gainesville, Florida
Photuris versicolor complex[d]	*Photuris versicolor* complex	Gainesville, Florida
Photuris sp. *A*[b]	*Photinus tanytoxus*	Gainesville, Florida
Photuris sp. *B*	*Photuris* sp. *A*	Gainesville, Florida
Photuris sp. *BR*	*Photuris* sp.	Archbold Biol. Sta., Florida
Photuris sp. *BR*[d]	*Photinus collustrans*	Gainesville, Florida
Photuris sp. *GR*	*Photinus collustrans*	Gainesville, Florida
Photuris sp. *LR*	*Photinus umbratus*	Gainesville, Florida
Photuris sp. *M*	*Photuris* sp. *M*	Pellston, Michigan
Photuris sp. *M*[d]	*Lucidota atra*	Pellston, Michigan
Photuris spp.	*Photinus* spp.	McDermott, 1917; Barber, 1951
Photuris spp.	*Photuris, Photinus, Pyractomena* spp.	Lloyd, 1969
Photuris sp.	*Photinus consanguineus* complex	Fife, Virginia
Photuris sp.	*Photinus floridanus* Fall	Gainesville, Florida
Photuris sp.	*Photuris* sp.	Oneida, New York
Photuris sp.	*Pyractomena angulata* (Say)	Nova Scotia, L. Buschman
Photuris sp.	*Pyractomena borealis*	Nova Scotia, L. Buschman
Photuris sp.	*Pyractomena linearis* complex	Nova Scotia, L. Buschman
Photuris sp.	*Pyractomena linearis* complex	Elizabethville, Ontario, Canada, J. Whitesell
Photuris sp. (n = 2)	*Pyractomena linearis* complex	Ann Arbor, Michigan
Firefly Predators (not adult females)		
Luciola discicollis larvae	*Luciola discicollis* larvae, eggs	Kaufmann, 1965
Photinus larvae[d]	*Photinus* larvae	Gainesville, Florida D. Minnick
Photuris larvae[d]	*Photuris* larvae	Gainesville, Florida D. Minnick, T. Lynch
Pyractomena limbicollis[d] Green larvae	*Pyractomena limbicollis* pupa	Gainesville, Florida

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[a] Species determination unreliable. *P. scintillans* = *P. marginellus.*

[b] Species code letters for new and undescribed *Photuris* species now under study.

[c] Locality only indicates J. Lloyd record.

[d] In laboratory.

would not eat fireflies when tested on days 6 and 7. Another skink began eating on day 1 but rejected fireflies when tested for the first time on day 7. A small fence lizard began eating on day 3 and rejected fireflies on day 5. Days or weeks later these same lizards ("had forgotten" and) seized fireflies again. After rejecting fireflies, predators ate maintenance prey. Fourteen (of 22) of Sexton's (1964) anoles would not attack *Photinus pyralis* after an interval of 11 months.

When a firefly was presented to a lizard within a few days of a previous firefly experience it would poke it with its snout and flick its tongue over it, or sometimes, without approaching the firefly, it would "smack its chops" in a fashion similar to that observed after a firefly had been seized (tasted).

Although Schwalb (1960) reported that toads would not take glowing females of *Lampyris noctiluca,* and Sexton (1960, 1964) observed that the Gray Treefrog (*Hyla versicolor*) vigorously rejected *Photinus pyralis*: "The toad advanced toward the beetle, flicked its tongue out and immediately withdrew it after it contacted the beetle. The beetle was left undisturbed in the terrarium side and never entered the hylid's mouth. The final reaction of the toad was to hold its mouth open and partially extend its tongue" (1964:107); other notes on amphibians indicate that they do eat fireflies, and perhaps even hunt them by their luminescence (see above). Harvey (1927) reported a luminous frog from Cuba—it had eaten fireflies, and their lights shone through its belly. I observed a similar event in the Everglades National Park with a green hylid and *Photuris* sp. *A*; Linsenmaier (1972:146) observes, with respect to luminescence 'frightening enemies', "That frogs are unimpressed by it is evident to anyone who sees the curious spectacle of a frog's stomach shining with the light of the firefly larvae it has recently swallowed."; Kiichiro (1961) fed *Luciola* fireflies to a frog and observed light through the frog's belly; "Frogs . . . do not mind the bad taste: they fill their cold bellies with fireflies till the light shines through . . ." (Hearn, 1902, based on S. Watase). A "tamed" luminescing wood frog, *Rang sylvatica,* was photographed for a technical publication dealing with photography, after "it had made a meal of fireflies" (Anon., 1969:50). *Hyla cinerea* eats *Pyractomena lucifera* (Melsh.) (Buschman, pers. comm.); "toads, it is said, have been known to eat them" (McDermott, 1910); and toads eat *Luciola discicollis* Castelnau (Kaufmann, 1965). I fed males of *Photinus umbratus* to 3 toads (*Bufo* sp.). Two of the toads seized and swallowed them, but the third immediately spat out the firefly—and its tongue. The latter hung to the floor for more than a minute while the toad stroked it vigorously with both forefeet. F. Test (pers. comm.) found a living *Pyropyga nigricans* (Say) larva in the stomach of a 40mm leopard frog (*Rana pipiens,* Cheboygan County, Michigan); it had been there at least 24 hours.

Carp eat fireflies in Japanese rice paddies (Kiichiro, 1961), but the aquarium fish *Cichlasoma* sp. rejects *Photinus pyralis* (Sexton, 1960). While working with chemical attraction in *Lucidota atra* at Douglas Lake, Michigan, I placed some females in a boat 20 feet off shore and released males on shore. One male flew out over the water toward the boat and then fell into the water. It was snapped from the surface of the water from below and then reappeared in about 2 seconds.

Invertebrate predators: Spiders are by far the most commonly mentioned invertebrate predators of fireflies (Balduf, 1935; Ridley, 1934; Schwalb, 1960; Zahl, 1962; Shelford, 1916; McDermott, 1958; Wood, 1939); spiders eat

Luciola discicollis (Kaufmann, 1965); *Luciola italica* (L.) is caught in spider webs (Blair, 1915); a salticid captured a *P. lucifera* larva (Buschman, pers. comm.); and although 2 New Guinea fireflies were eaten by the colonial spider, *Cyrtophora moluccensis* (Doleschall), 9 other individuals (*Luciola* spp., *Pteroptyx* sp.) were found under the colonial webs, having been rejected (Y. Lubin, pers. comm.). Table 2 summarizes my data on spiders and their firefly prey.

I once observed a large lycosid that had captured a *P. congener* male. Although the flash code of this firefly is not completely understood, the flash response of the female, and aggressive mimics, to male flashes appears to be rapid single flashes that bear no specific time relationship to the male flashes. The captured male emitted rapid single flashes and drew in 2 more males: the spider grabbed and held these as it ate the first. The sporadic flashes of a *Photuris* sp. "*HS*" male in New York that was dangling in a spider web drew another flying male into the web. I also observed this with a luminescent elaterid beetle, *Pyrophorus texanus* Hyslop, in Texas.

On a number of occasions I have observed lycosid spiders in close proximity to, or capturing perched or grounded, flashing fireflies. While I was attracting a *Photuris* sp. "*A*" male to a flashlight, the firefly was seized by a spider as it walked the last 8 inches to the light, and a *Photinus collustrans* LeC. male that was walking to a glowing female in an open dish (in which I had placed her to attract a male) was seized by a lycosid that dashed away with him several inches before dropping him. Males of *Photinus umbratus* remain perched on low grass flashing after their evening activity: several times I have found lycosids within inches of them or eating them.

Other invertebrates reported to have eaten fireflies are a snail (ate a glowworm) (Newall, 1897), a brown centipede (McDermott, 1958), the Monedula wasp and an asilid fly (Hudson, 1922), a crustacean (*Cambaroides japonicus*) (Kiichiro, 1961), and a staphilinid beetle (*Goerius,* now *Staphilinus olens*) (Dale, 1834). The pupa of a firefly I was rearing (*Pyractomena dispersa* Green) was eaten by a pillbug *Armadillidium* sp., and on 3 occasions I have seen harvestmen eating living fireflies (*Photuris* spp., *P. scintillans*). In one situation the firefly was flashing brightly, and it was well after dark. One harvestman has been identified as *Leiobunum* sp.

The fire ants, *Solenopsis geminata* (Fabr.) and *S. invicta* Buren, ate *Photuris* sp. fireflies placed in a test chamber attached to their nest by a glass tube, but *Conomyrmex pyramicus* (yellow form) did not, although it did take other insects (A. Bhatkar, pers. comm.). Black ants in West Africa eat *Luciola discicollis* (Kaufmann, 1965), *Oecophylla* sp. in Jahore feeds upon *Pteroptyx* fireflies (I. Polunin, pers. comm.), *Solenopsis molesta* (Say) ate dead *P. pennsylvanica*[3] and *P. consanguineus*[3] (Jones, 1932), and ants ate 6 non-luminescing fireflies but left glowing ones untouched (Travers, 1924). I fed *Photinus obscurellus* to antlions, and in the field found a reduviid bug (*Zelus* sp.) feeding upon a female *Photuris congener.* F. Hanson (pers. comm.) in Hoskins, New Britain, observed the attack of a reduviid bug upon a male *Pteroptyx* firefly: the firefly was seized and quickly released, apparently unharmed. I fed several fireflies to the mantid *Brunneria borealis* Scudder. It ate *Photuris* sp. "*A*" and rejected *Photinus umbratus* several times. It accepted a *Photinus consanguineus* male, chewed on him several seconds then dropped him. It rejected this firefly once again after eating a mealworm. After eating a second mealworm it ate the firefly. Linn (1972) "watched a pet praying mantis repeatedly seize fireflies tentatively and then throw them as far away as possible."

Firefly females of some *Photuris* species are carnivorous. Furthermore, some mimic the mating flashes of females of other species, attract their males, and eat them (Lloyd, 1965, 1969). There are several literature accounts of *Photuris* sp. females eating males of other species. Table 3 lists these, along with personal communications, and my own records.

Other suggested functions of firefly luminescence pertaining to predator defense are protective resemblance to luminescent bacteria and fungi (Lloyd, 1966, p 68), and dazzling the eyes of predators and disguising the insect's position (Riley, 1880). It is only a matter of time until a theoretical ecovitalist suggests that luminescence is part of a "homeostatic mechanism" to regulate population density by attracting predators to eat up superfluous individuals for the good of the species.

In conclusion, actual knowledge of firefly predators is meager, but it suggests that (some) fireflies are distasteful to some predators, and that some predators such as goatsuckers (Caprimulgidae), potoos (Nyctibiidae), spiders (Araneidae, Lycosidae), certain anoles (Iguanidae) and frogs possibly specialize on firefly prey at least during certain times or seasons. Other records of vertebrate predation appear to be incidental. Firefly females of several *Photuris* species prey upon the males of several species of *Photinus, Photuris* and *Pyractomena.*

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BOOK REVIEW

Bibliography of Interlingual Scientific and Technical Dictionaries (Fifth Edition). 1969. Unipub, Inc., P.O. Box 433, N.Y., N.Y. 10016. 250 p. Cloth, $9.00.

This is an unusual bibliography since it covers 2,491 dictionaries under 263 subject headings and 75 languages. Over 200 entries are cross-referenced, and there is an index to author, subject, and language. There are only 16 dictionaries listed under zoology and 1 under "Insectology", although a variety of other entries would also be of interest to biologists. A great time-saver in locating such dictionaries.—R. E. Woodruff.

THE
COLEOPTERISTS
NEWSLETTER

No. 9 JUNE, 1973

EDITOR: CHARLES W. O'BRIEN, UNIV. P. O. BOX 111, FLORIDA A AND M UNIVERSITY, TALLAHASSEE, FL 32307

With the permission of the executive council, we are trying a new format and method of presentation with this Newsletter. We welcome your comments and suggestions. This format should reduce the cost of the Newsletter and will not increase the cost of the Bulletin. The savings are mainly in the cost of mailing.

Because Lois and I will be in Central America for the summer, important notices should be sent directly to Dr. Robert E. Woodruff (P. O. Box 1269, Gainesville, FL 32601) for inclusion in the September issue.

NOTICES OF MEETINGS

ANNUAL MEETING OF THE COLEOPTERISTS SOCIETY

The meeting will be held in conjunction with the annual meeting of the Entomological Society of America in Dallas, Texas, November 26-29, 1973. A field trip for coleopterists to Welder Wildlife Refuge, Sinton, Texas, is being planned after the meeting. Further information will be given later.

SIXTH LATIN AMERICAN CONGRESS OF ZOOLOGY

The congress will meet in Mexico City, October 1974. The official languages will be Spanish and Portuguese. For further information, write to Dr. Gonzalo Halffter, Cerrada de Monte Kamerum No. 34, Lomas de Chapultepec, Mexico, 10, D.F.

FIRST INTERNATIONAL CONGRESS OF SYSTEMATIC AND EVOLUTIONARY BIOLOGY

In conjunction with these meetings, to be held in Boulder, Colorado, 4-11 August 1973, there will be two semi-formal meetings of coleopterists to be convened by Terry Erwin and George Ball. General information about the Congress can be obtained by writing to: ICSEB—1973, c/o Robert W. Pennak, Department of Biology, University of Colorado, Boulder, COLORADO 80302 U. S. A.

COLEOPTERISTS' GATHERING: This is to be held August 6, 1973 at 7:30 P.M., place to be announced during the Congress. Anyone interested in beetles is cordially invited to attend. The purpose is to provide a forum for exchange of ideas on a variety of topics. The meeting will be without a formal agenda. Those in attendance will be invited to contribute to discussion of the topics listed below. We are hoping that the gathering will be international, and that the residents of this continent will take the opportunity to acquaint their overseas colleagues with the goals and sorts of studies in progress in North America. Conversely, we should avail ourselves of the opportunity to learn about the special problems being studied in other parts of the world.

Suggested Topics for Discussion are the North American Beetle Fauna Project; application of computers to problems of information storage and retrieval; papers on beetles: what they are, what they should be; beetle larvae in relation to classification; fossil and sub-fossil Coleoptera; evolution and classification of Coleoptera: trends and high-ranking taxa; montane beetle faunas; and continental drift and evolutionary rates of beetles.

CONFERENCE OF CARABID SPECIALISTS: This is to be held August 7, 1973 at 7:30 p.m., place to be announced at the Congress. Anyone interested in carabid beetles is cordially invited to attend. There is no agenda, and those in attendance will be invited to present accounts of their current research, and their plans for future work. They will also be invited to raise topics for discussion.

Questions, comments or suggestions may be sent to the following address: George E. Ball, Department of Entomology, University of Alberta, Edmonton, Alberta, Canada, T6G 2E3.

MEXICAN COLLECTING AUTHORIZATION

The following letter was received from Dr. Gonzalo Halffter:

The Consejo Nacional de Ciencia y Tecnología [CONACYT], in fulfillment of the 2nd article of the law that created it, has established a system to coordinate the work of foreign scientists in Mexico.

CONACYT wishes to simplify procedures and help foreign scientists who want to work in our country. Thus the committee of Biological Sciences and the Center of International Cooperation of CONACYT have established the following procedures for obtaining a collecting permit. The person interested should write to **Lic. Manola Alvarez Sepúlveda, Oficina de Internaciones, Centro de Cooperación Internacional, Consejo Nacional de Ciencia y Tecnología, Insurgentes Sur 1677, México 20, D. F.,** requesting the permit for collection and supplying the following data: 1) Plan of work; 2) Place and date of its development; 3) Curriculum vitae (optional); 4) Institution and speciality; 5) Responsible or adviser; 6) Number of participants in the expedition.

Lic. Alvarez will immediately get in touch with the Biological Sciences Committee requesting the opinion of **Dr. Gonzalo Halffter** for the collection of **animals** and of **Dr. Arturo Gómez Pompa** for the collection of **plants.** The Biological Sciences Committee will immediately answer Lic. Alvarez, and she will write to the foreign solicitor, informing him of the decision reached and supplying, when necessary, a letter addressed to the civil and military authorities in order that they give him all the facilities he needs in his studies. **For game species,** the Mexican laws state that it is necessary to get a permit from the Dirección General de la Fauna Silvestre, a dependency of the Secretaría de Agricultura. CONACYT can arrange or indicate to the interested party what formalities he needs to follow. **For invertebrates** there is no need for such an additional permit, only the authorization from CONACYT.

Depending on the kind of work to be done, CONACYT may request the visiting scientist to give a conference in one of the high educational centers or else to deposit duplicates of the collected specimens in one of our institutions chosen in mutual agreement. In all cases, he must give us a brief communiqué with the results of his studies, sending us his publications later on.

With this information, we wish to establish a directory of zoologists and botanists interested in animals and plants of Mexico and also to facilitate the work of our visitors indicating to them the collections that exist already in the country and the institutions with which they can establish programs of collaboration, that will relate the visiting scientists with their Mexican colleagues.

Permits will be issued among colleagues with the best spirit of cooperation. It is very important to specify that this permit refers to scientific collectors. People who are engaged in a commercial enterprise do not fall under the authority of CONACYT. However, we ask, in the same spirit of cooperation, the help of all visiting scientists, to denounce those cases in which an illegal trade is established with species near extinction or which endanger the existence of a specific fauna, such as cave or endemic faunas, etc.—Dr. Gonzalo Halffter, Technical Secretary, Comité de Ciencias Biológicas, CONACYT.

NOTICE OF PROPOSED CHANGES TO THE CONSTITUTION AND BY-LAWS

The changes proposed below are recommended by the Executive Committee. It is felt that they will increase organizational stability by increasing the continuity of the Executive Committee.

Article VI of the Constitution prescribes procedures for amendments: briefly, such must be approved by a majority of the Executive Committee, two months notice of the proposed changes must be given, and approval of two-thirds of those voting in a mail ballot must be received for ratification. Ballots will be mailed sometime during the fall.

An informal agreement reached by members present at the 1972 annual meeting in Montreal was to the effect that the Treasurer and Secretary occupy their offices on an extended basis. Thus a person elected to one of these offices would be eligible for re-nomination annually for as long as he is willing to remain in office and that the Nominating Committee would not propose a nominee to run against the incumbent. The Executive Committee thinks it desirable that the intent of this agreement be made formal.

Additionally, the Executive Committee wishes (1) to have the Vice-President be President-Elect, and to become President at the end of his term as Vice-President, and (2) to have the immediate Past-President be a member of the Executive Committee for the term following his relinquishment of the office of President. However, the present officers do not wish to extend their own terms by these means, and so two of the proposed amendments, if approved, will not take effect until the 1974 elections.

A. ARTICLE V: Presently states: "Officers Section 1: The elective officers shall consist of President, Vice-President, Secretary, Treasurer and a six member council."

Proposed amended version (to take effect at the time of the annual election to be held in 1974): "OFFICERS SECTION 1: THE ELECTIVE OFFICERS SHALL CONSIST OF THE PRESIDENT, WHO SHALL AUTOMATICALLY AND WITHOUT ELECTION ACCEDE TO THE POSITION FROM THAT OF VICE-PRESIDENT; THE VICE-PRESIDENT WHO SHALL BE THE PRESIDENT-ELECT; THE SECRETARY; THE TREASURER; AND A COUNCIL OF SIX MEMBERS.

B. BY-LAWS II, SECTION 1. Presently states: "The officers and council of the Society shall serve as the Executive Committee."

Proposed amended version (to take effect at the time of the annual election to be held in 1974: "THE OFFICERS AND COUNCIL OF THE SOCIETY SHALL SERVE AS THE EXECUTIVE COMMITTEE. THE IMMEDIATE PAST-PRESIDENT OF THE SOCIETY SHALL SIT FOR ONE TERM AS AN *ex-officio* MEMBER OF THE EXECUTIVE COMMITTEE, AND SHALL BE ENTITLED TO VOTE".

C. BY-LAWS II, SECTION 9. Presently states: An officer or council member may be re-nominated but may not serve for more than two consecutive terms".

Proposed amended version (to take effect at the time of the annual election to be held in 1973): "THE PRESIDENT OR VICE-PRESIDENT MAY NOT SUCCEED HIMSELF IN THAT OFFICE; A COUNCIL MEMBER MAY BE RE-NOMINATED BUT MAY NOT SERVE FOR MORE THAN TWO CONSECUTIVE TERMS".

Note—This amendment has two aspects: first, it removes fixed terms from the offices of Treasurer and Secretary; and second, by providing that the offices of President and Vice-President must have new occupants every term, it is consistent with the proposed amended version of Article V, Section 1.

PLEOCOMA TO BE STATE INSECT?

The Oregon Entomological Society, through coleopterists Rick Westcott and Loren Russell, is attempting to make Oregon the first State to recognize a *beetle* as "State Insect". (According to our scorecard, a butterfly, a bee, and a mantid are already enthroned in various states.) The OES's nominee is the "Oregon Rain Beetle" (*Pleocoma oregonensis,* and by implication other Oregon *Pleocoma*). There is a strong tie-in to the rain cult common to Oregon society, which has previously blossomed in such forms as the James G. Blaine Society, dedicated to keeping "Oregon for Oregonians" by promoting the image of a soggy Oregon.

The bill designating the rain beetle was introduced by Rep. Paul Walden of The Dalles, who incidentally owns an orchard full of *P. oregonensis*. While the rain beetle bill has encountered surprising public controversy, including a hostile editorial in the state's largest newspaper, it has made "rain beetle" a household word in Oregon, and we expect eventual victory.

The OES is a no-bylaws, no-dues organization which has persisted since 1939. Our quarterly newsletter contains entomological news of regional interest and records the activities of members; it is available free on request. (We also have a stock of rain beetle lapel buttons, for those who collect coleopterological artifacts; cost is 35¢.)——Loren Russell, Secretary, Department of Entomology, Oregon State University, Corvallis, OR 97331.

TROPICAL TRAINING AND RESEARCH CENTER

I have just spent from January 3 to February 9 studying insect and plant life in Costa Rica. I visited the Tropical Training and Research Center of the Inter-American Institute of Agricultural Science (IICA), which is a member of the Organization for Tropical Studies.

In addition to presenting a seminar on my research on ground beetles of cropland, I accompanied IICA staff members on field trips and made independent studies and collecting trips throughout the country.

The library, laboratory facilities, and living accommodations for visiting scientists at the Institute were very good, and the instruction and research being conducted there are of high caliber. About 2,000 acres at IICA are devoted to plantings of coffee, sugarcane, cocao, and pastures for dairy research. Nearly 50 students from throughout Latin America are currently enrolled there as candidates for their MS degrees——Vernon M. Kirk, USDA, ARS, Brookings, South Dakota.

FLORIDA KEY FORAY

Jim Wappes, Herman Flaschka, Robert Turnbow, Steve Ashe, Roger Ables and I banded together for a short beetle collecting excursion from March 22-25, centering our efforts on Key Largo, and Big Pine Keys, Florida. A few stray (and doubtless uncommon!) cicindelids were collected on other Keys. Stiff winds day and night interfered with both blacklighting and beating, but persistence and an ability to ignore deerflies and mosquitoes paid off in some very nice beetles. I was particularly excited to locate nests that Bob Woodruff told us about of the Florida woodrat (*Neotoma floridana smalli*). In these nests I got additional specimens of a new Leptotyphline staphylinid, Scarabaeidae (aphodiines, canthonines, acanthocerines), the blind weevil *Caecossonus,* and a variety of scydmaenids and ptiliids. The cerambycid specialists (Wappes, Flaschka, Ashe) got a couple of hundred specimens in about 20 species. They also turned up several nice buprestids and a number of specimens of the odd little weevil *Erodiscus.* Turnbow got a very nice small brentid, *Stereodermus.* Jim Wappes and Steve Ashe each got a specimen of the largest, most colorful tortoise beetle I have yet seen. All in all the hours of driving and beating the brush were well repaid.——Jim Cornell, Allen Science Res. Inc., Charlotte, N. Carolina.

NEWS OF MEMBERS

DR. E. C. ZIMMERMAN has joined the staff of CSIRO in Canberra, Australia. His first tasks will be an illustrated revision of the genera of Australian weevils and a catalogue of the species.

FLORIDA VISITORS

In addition to those mentioned in Jim Cornell's "Florida Key Foray", several other Coleopterists have recently visited Florida.

From 6-8 April 1973 there was a meeting of the Board of Directors of the "North American Beetle Fauna Project" at Tall Timbers Research Station, north of Tallahassee. In addition to the Managing Director, Dr. Ross Arnett, the following were present: Dr. Robert T. Allen, Dr. George E. Ball, Dr. John N. Belkin, Dr. Richard E. Blackwelder, Dr. John A. Chemsak, Dr. Eugene J. Gerberg, Dr. E. V. Komarek, Sr., Dr. Charles W. O'Brien, and Dr. R. E. Woodruff.

After the meetings Dr. Chemsak and Dr. Ball visited with us in Gainesville and studied specimens in the Florida State Collection of Arthropods. Dr. Ball also presented a seminar at the University of Florida on his carabid research.

On March 22, 1973 Willie Rosenberg from Hazelwood, N.C. and Lester Lampert from Asheville, N.C., visited in Gainesville and then spent some time at Archbold Biological Station near Lake Placid, Fla.

Dr. Arthur E. Lewis, M.D., cerambycid collector from Burbank, Calif., spent several days, with his wife, collecting in Florida in late May and visiting the Florida State Collection of Arthropods on 29 May 1973.

Dr. N. M. Downie, former editor of The Coleopterists Bulletin and general Coleopterist from Purdue Univ., visited the FSCA in Gainesville on 7 March 1973.

Although not a visitor, Dr. Reece I. Sailer (former Chief, Insect Identification and Parasite Introduction Branch, USDA) is now in Gainesville, Florida as a Research Professor at the University of Florida. We are not trying to claim him as a Coleopterist, but we know he has dealt with many of our readers and felt they would be interested in this change.—R. E. Woodruff

CHARLES E. WHITE COLLECTION

Charles E. White, 2441 E. Northview Ave., Indianapolis, Ind., 46220, died in March, 1973. His extensive Coleoptera collection has been donated to the Florida State Collection of Arthropods, Gainesville. Dr. Ross Arnett accompanied me on a trip there to pick up the collection in early May. We visited with Dr. N. M. Downie in Lafayette and were joined there by Dr. Richard Jacques who flew in from Farleigh Dickinson Univ. for the Purdue graduation.

The collection is housed in a 50 drawer cabinet meticulously made by Charlie. The greatest emphasis is on the families Carabidae and Cerambycidae, although there is good general representation. Charlie did some exchanging and obtained a wealth of material from a series of blacklight traps scattered around Indiana. His son, David, is interested in Plecoptera and Lepidoptera, and we hope he will provide us with a more complete biographical resumé soon.—R. E. Woodruff

NOTICES

LUCANIDAE: World revision of most genera; prefer exchange for lucanids or other beetles; will identify loans, will buy if necessary. Hughes E. Bomans, 39 Avenue Charles Verhaegen, 1950 CRAINHEM, Belgium.

MICROPEPLIDAE: Working toward a world monograph of the entire family. Specimens, praeimaginal stages, distribution and/or ecological records needed from all areas of the World, by loan, or general exchange, correspondence invited.

SILPHIDAE: Presently revising the genus *Agyrtes* for World. Request loan of adults and/or larvae & pupae. Distribution and ecological records welcome.

STAPHYLINIDAE: Revising the genus *Bryocharis* (subfam. Tachyporinae). Request loan of New World and East Asiatic material especially. Petr Nohel, Botany Inst., Czech. Acad. Sci., 25243-Pruhonice nr. Prague, Czechoslovakia.

BUPRESTIDAE: 50 *Euchroma gigantea* (av. 6cm) plus general collection, unidentified, in alcohol, from CANAL ZONE (many scarabs, longhorns, etc.) to trade for any interesting Coleoptera. David Swanson, 502 Beech St. A-4, Savanna, Ill. 61074.

SCARABAEIDAE: *Chalcosoma atlas* and subspecies from Malaysia, Philippines, Java, & Sumatra (5-11cm) FOR SALE. K. A. Schmitt, W168 N11469 El Camino, Germantown, Wisc. 53022.

(*continued from inside front cover*)

or counties listed. Dates are listed by day, month (in Roman numerals), and last 2 digits of the year. Listing of ecological data is encouraged. Location of specimens should be shown in brackets; if the data is extensive these should be abbreviated as shown and the abbreviations listed in the text.

Any article concerning Coleoptera will be considered. Descriptions of new taxa must contain keys (or be correlated with existing keys) and illustrations. All manuscripts should be typed on 8½x11" opaque white paper with 1 inch margins. They should be typed on one side only and double spaced throughout (including title, footnotes, tables, figure legends, and references). All scientific names should be underlined. Use the following order: title, author, author's address, abstract, body of text, references cited, and figures. All footnotes, tables, and figure legends should be provided on separate sheets and double spaced. Indicate approximate figure and table locations in pencil in the margin of the manuscript.

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HYDROPHILIDAE: Presently revising the genus *Hydrochus* from North, South, and Central America, including the Antilles. Request loan of any material from the Western Hemisphere. John L. Hellman, Ent. Dept., Univ. Maryland, College Park, MD 20742.

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COCCINELLIDAE: North American specimens and locality records of ***Coccinella undecimpunctata*** L. required for distribution study of this species. M. Y. Watson, Dept. Biology, Laurentian Univ., Sudbury, Ontario, Canada.

REPRINTS DESIRED: Now working on the interpretation and integration of available evidences on phylogeny in construction of a phylogenetic classification of Coleoptera. Reprints are requested from specialists in all families. Mohammad Abdullah, Zoologische Staatsammlung, 8 Munich 19, W. Germany.

CARABIDAE: Need material for study of New World ***Philochtus*** (Bembidiini) including ***Cyclolopha.*** G. G. Perrault. 138 Rue Houdan, 92, Sceaux, France.

LUCANIDAE: Buy, sell, exchange all species. Also wanted: collection data and World literature on the family. Chris Adamson, 2030 Bancroft Way No. No. 5, Berkeley, CA 94704.

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CERAMBYCIDAE: Preparing checklist of species in Tennessee. Request data from any Tennessee specimens. Hoyt L. Jamerson, Dept. Biology, Memphis State Univ., Memphis, TN 38152.

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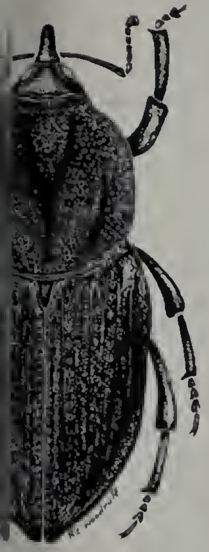
THE COLEOPTERISTS BULLETIN

VOLUME 27, NUMBER 3 SEPTEMBER, 1973



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THE COLEOPTERISTS BULLETIN

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The **Coleopterists Bulletin** is published quarterly, beginning in March, by the Coleopterists Society. All manuscripts, editorial questions, or business matters should be sent to the editor: Dr. Robert E. Woodruff, Florida Dept. Agr., Div. Plant Ind., P. O. Box 1269, Gainesville, Florida 32601.

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Manuscripts will be considered from any authors, although those from members of the Coleopterists Society will be given priority. It is suggested that all prospective authors join the Society. All manuscripts should conform to instructions in the **Style Manual for Biological Journals** (3rd Ed.) prepared by the Committee on Form and Style of the Conference of Biological Editors, and published by the American Institute of Biological Sciences, 2000 P Street NW, Washington, DC 20063.

The following exceptions are noted: 1) All geographical names are to be spelled out, 2) use words, not symbols, for male and female, 3) use numerals throughout, except to begin a sentence, 4) entomology, -ical, -ist, etc. are to be abbreviated Ent. in literature citations.

Specimen label data should be listed in the following manner: MEXICO: State of Veracruz, Fortin de las Flores, 10-VIII-70, I. B. Jones, under bark of **Pinus moctezumae,** 7000ft. [USNM] (2). The number in parentheses indicates the number of specimens. Geographical names are listed in order with largest units first, with states,

Continued inside back cover

(Mailed under second-class permit at Gainesville, Florida. Postmaster: send form 3579 to editorial office—Dr. R. E. Woodruff, Florida Dept. Agr., Div. Plant Industry, P. O. Box 1269, Gainesville, FL 32601).

A DESCRIPTION OF THE LARVA OF *HYPOTHYCE MIXTA* HOWDEN (COLEOPTERA:SCARABAEIDAE:MELOLONTHINI)[1]

Paul O. Ritcher

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Abstract

The first and second stage larvae are described and illustrated for the recently described *Hypothyce mixta* Howden, from near Garrison, Texas.

Carl Barfield, formerly a student at Nagadoches State College[2], has furnished to me a number of reared first stage larvae of *Hypothyce mixta* and a partly molted second instar. This makes it possible to describe the larvae of this recently described genus and species (Howden, 1968) and to compare it with larvae of the closely related genera, *Thyce* and *Polyphylla.*

Larvae of *Polyphylla* and of the 1 known species of *Thyce (T. harfordi* Casey) are so similar in morphological characters (Erwin, 1970) that they could be placed in the same genus. Adults of *Thyce,* however, have a 3-segmented antennal club while that of *Polyphylla* is many segmented (LeConte and Horn, 1883).

The larva of *Hypothyce* shows close affinities with the larvae of both *Polyphylla* and *Thyce* but has a strikingly different type of raster. This feature of *Hypothyce* larvae supports Howden's creation of a new genus for the species (1968).

Hypothyce larvae more closely resemble *Thyce* larvae than *Polyphylla* larvae in having more posterior frontal setae on the head and a short dexiophoba on the epipharnyx. Unlike both *Thyce* and *Polyphylla,* larvae of *Hypothyce* have relatively few (8-11) preseptular hamate setae.

First-Stage Larva
(Fig. 1, 3, 4-8)

Description based on 35 first instars reared by Carl S. Barfield, summer and fall 1971, from eggs laid by females of *Hypothyce mixta* collected at Camp Whispering Pines, near Garrison, Texas.

Maximum width of head capsule (Fig. 6) of first-stage larva 2.07 to 2.25 mm, light yellow brown, fairly smoothe. Dorsoepicranial setae, 1 to 3 on each side. Frons with 16 or 17 anterior frontal setae, an irregular, transverse row of 5-10 posterior frontal setae on each side, 1 or 2 exterior frontal setae on each side, and 2 or 3 setae in each anterior frontal angle. Labrum symmetrical, with a broken network of prominent brown carinae. Post-clypeus with similar but less prominent carinae. Epipharynx symmetrical (Fig. 1); epizygum, zygum, and proplegmatia absent. Haptomerum slightly raised, set with 14 to 16 heli in 2 curved transverse rows. Plegmatia well developed, each elliptical with 12 to

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[1] This research was supported in part by grant GB-31129 from the National Science Foundation; Oregon Agricultural Experiment Station, Technical Paper No. 3497.

[2] Now a graduate student at Texas A and M University, College Station, Texas.

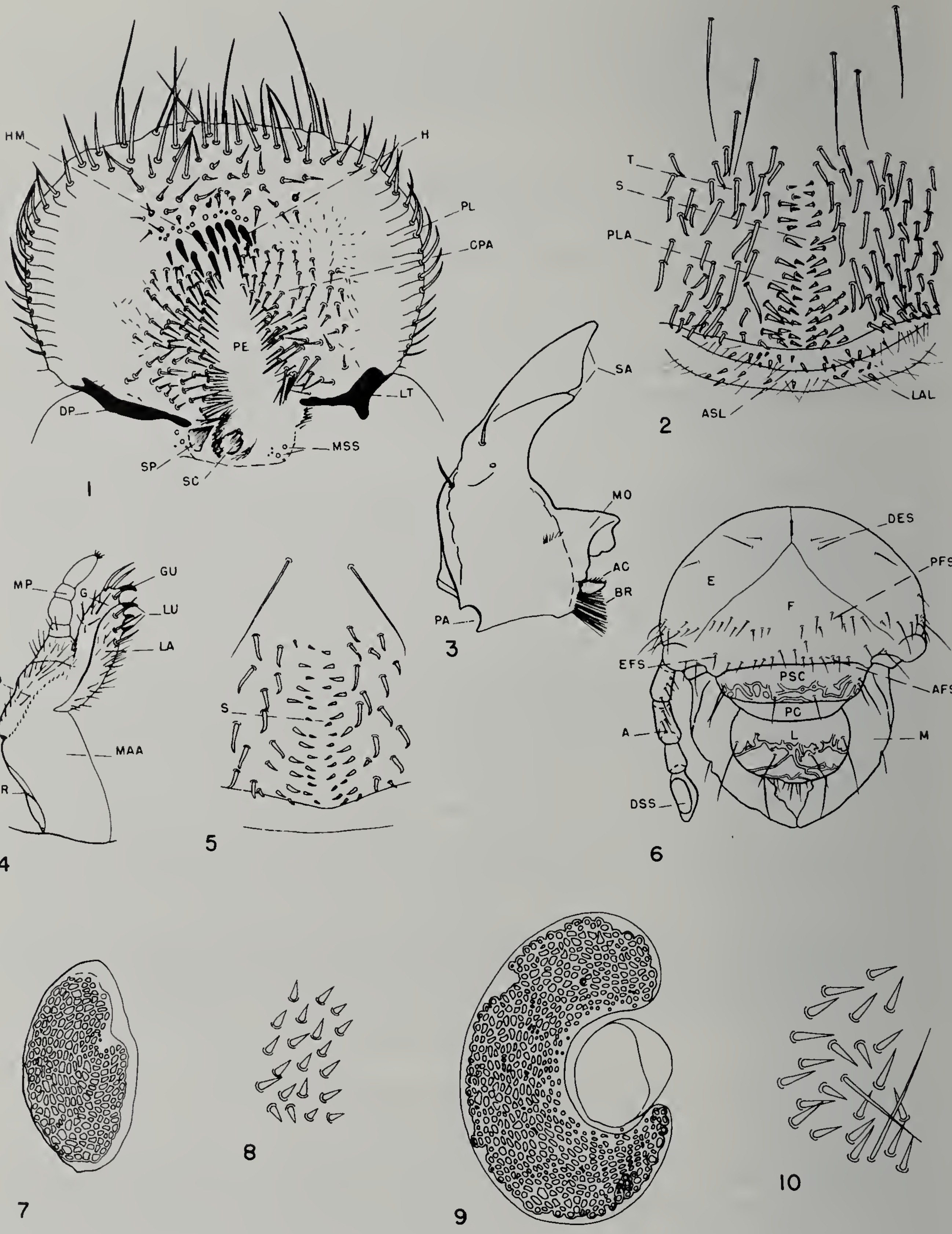

Fig. 1, 3-8: First instar: 1) epipharynx. CPA, chaetoparia; DP, dexiotorma; H, helus; HM, haptomerum; MSS, macrosensilla; PE, pedium; PL, plegmatium; SC, sense cone; SP, sensoryplate. Fig. 2, 9, 10: Second instar: 2) raster. ASL, anal slit; LAL, lower anal lobe; PLA, palidium; S, septula; T—tegillar setae. 3) Mandible, AC, acia; BR, brustia; MO, molar area; PA, preartis; SA, scissorial area. 4) maxilla. CAR, cardo; G, galea; GU, uncus of galea; LA, lacinia; LU, unci of lacinia; MAA, maxillary articulating area; MP, maxillary palpus; SD, stridulatory teeth. 5) raster. S, septula. 6) head. A, antenna; AFS, anterior frontal setae; DES, dorsoepicranial setae; DSS, dorsal sensory spot; E, epicranium; EFS, exterior frontal seta; F, frons; L, labrum; PC, preclypeus; PFS, posterior frontal setae; PSC, postclypeus. 7) Left thoracic spiracle. 8) Typical setae of second dorsal fold on second abdominal segment. 9) Left thoracic spiracle. 10) Typical setae of second dorsal fold on second abdominal segment.

17 plegmata. Chaetopariae each with a dense covering of medially directed setae; sensilla absent. Dexiophoba fringing basal half of pedium; small laeophoba anterior of medial end of laeotorma. Haptolachus with thin, triangular sclerotized plate (nesium externum) and sense cone surrounded by numerous setules. Region anterior of crepis and mesad of 2 macrosensillae with 3 microsensillae. Tormae separate, asymmetrical; dexiotorma with well developed pternotorma.

Mandibles (Fig. 3) elongate with black scissorial and molar area. Dorsomolar region of left mandible with a row of 5-11 setae. Maxilla (Fig. 4) with galae and lacinia fused at base, tightly fitted together apically. Lacinia with 3 unci in a longitudinal row. Maxillary stridulatory area with sparsely set row of 14 to 17 short, sharp, subconical teeth. Antenna 4 segmented, shorter than mandible; last segment broadly elliptical, wider than segments 1 to 3; with a large elliptical, dorsal, sensory spot.

Spiracles reniform, bullae absent, with slightly concave respiratory plates. Respiratory plates with irregular rows of subquadrate "holes" (Fig. 7). Spiracles of abdominal segments 7 and 8 slightly smaller than those of 1-6.

Legs 4 segmented. Prothoracic and mesothoracic legs with sharp pointed falcate claws; claws of metathoracic legs much smaller. Each claw with 2 prominent setae.

Abdominal segments 1-6 each with 3 dorsal lobes covered with numerous short, stout subconical setae (Fig. 8). A few very long slender setae found posteriorly among the short setae on lobes 1 and 2. Segment 7 with dense short setae only on fold 1; fold 2 with scattered long and short slender setae.

Raster (Fig. 5) with 2 palidia, each consisting of several sparsely set, irregular rows of subconical, mesally directed setae; some with bent tips. Each palidium triangular with 23-31 pali arranged in 1 or 2 irregular rows anteriorly and widening to 3 or 4 irregular rows posteriorly. Septula long and narrow, almost obsolete. Tegillum with numerous long strap-like setae, curved at tips. Preseptular tegillar setae 8 to 11. Anal slit broadly curved, lower anal lobes covered with many slender setae and a few short stout, conical setae.

Second-Stage Larva
(Fig. 2, 9, 10)

Description based on 1 second instar reared from an egg of *Hypothyce mixta* laid by female no. 1, collected at Camp Whispering Pines, near Garrison, Texas, by Carl S. Barfield. Larva preserved 25-X-1971 when molt skin of 1st instar was in the process of being shed.

Setation of head, carinae of frons and postclypeus, epipharynx, mandibles, and maxillae as in first instars.

Spiracles C-shaped, with bullae (Fig. 9). Thoracic spiracle with posterior emargination of respiratory plate; abdominal spiracles with anterior emarginations of respiratory plates. Thoracic spiracles slightly larger than abdominal spiracles; abdominal spiracles similar to each other in size.

Lobes of respiratory plates of thoracic spiracle slightly constricted; respiratory plates of abdominal spiracles not constricted or slightly constricted. Respiratory plates with numerous circular to subquadrate "holes" not arranged in definite rows.

Setation of dorsal folds of abdomen (Fig. 10) as in first instar, except setae are longer and more numerous. Raster (Fig. 2) with 2 palidia of 27 to 28 short to moderately long, straight, sharp-pointed pali. Each palidium with pali arranged anteriorly in a single irregular row and posteriorly widening to 2 or 3 irregular rows. Septula long and narrow.

Literature Cited

Erwin, T. L. 1970. A description of the larva of *Thyce harfordi* Casey (Scarabaeidae: Melolonthini) Psyche 77(1):50-53.

Howden, H. F. 1968. Generic relationships of *Thyce, Plectrodes, Dinacoma,* and *Hypotrichia,* with a description of a new genus and species from eastern Texas (Coleoptera: Scarabaeidae: Melolonthini). Canadian Ent. 100(5):542-548.

Leconte, J. L., and G. H. Horn. 1883. Classification of the Coleoptera of North America. Smithsonian Misc. Coll. 507:1-567.

Ritcher, P. O. 1966. White grubs and their allies, a study of North American scarabaeoid larvae. Oregon State Univ. Press, Studies in Entomology 4:1-219.

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HOMAEOTARSUS DESPECTUS LeCONTE FROM MEXICO

Ian Moore

Division of Biological Control, Department of Entomology
University of California, Riverside 92502

Homaeotarsus despectus LeConte was originally described from Louisiana (LeConte, 1863, Smithsonian Misc. Publ. 167:45). Horn (1885, Trans. Amer. Ent. Soc. 12:90) reported it from Florida. Casey (1905, Trans. Acad. Sci. St. Louis 15:40) added Brownsville, Texas to the known distribution. A male specimen from Zihuatanejo, Guerrero, Mexico, 15-IX-1966, R. H. Crandall, is identical with specimens in the collection of the University of California at Riverside from Gainesville, Florida sent to us by C. W. O'Brien. It is easily known as the only U. S. species with the apices of the elytra narrowly testaceous. Specimens of *despectus* answer perfectly to Sharp's brief description of *H. apicipennis* (1885, Biologia Centr. Amer. p. 526) from southern Mexico, Guatemala, and Nicaragua. The types of the 2 species should be compared to determine the status of the latter.
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THE *SPALACOPSIS* OF THE WEST INDIES AND AMERICA NORTH OF MEXICO (COLEOPTERA: CERAMBYCIDAE)

W. H. Tyson*

593 W. San Jose Ave., Fresno, CA 93704

Abstract

The taxonomy and distribution are discussed for the 9 species and 2 subspecies found in America north of Mexico and in the West Indies. A key is presented for separation of the species, and the following new species are described: *Spalacopsis (s. str.) chemsaki* from Florida, *Spalacopsis (s. str.) unicolor* from Puerto Rico, *Spalacopsis (Euthuorus) macra* from Jamaica, and *Spalacopsis (E.) filum brevialatum* from the Dominican Republic. *Spalacopsis confusa* Casey, *scapalis* Casey, *suturalis* Hamilton, *pertenuis* Casey, and *exilis* Casey are reduced to synonymy. The validity of *Spalacopsis grandis* (Chevrolat) is questioned, and *Spalacopsis lobata* Breuning is resurrected from synonymy. Drawings, photographs, and distribution maps are included.

The lamiine genus *Spalacopsis* has previously been placed into several tribes; the Hippopsini, the Spalacopsini, and more recently into the Agapathiini (Breuning, 1962). Much information on the biology, immature stages, and morphology is needed before the taxonomic placement of *Spalacopsis* is totally clear. It is most similar to the Ethiopian-Oriental genus *Tetraglenes.*

Spalacopsis is unique in having small circular eyes (proposed to be the result of the degeneration and loss of the lower lobe and connecting row of facets by Tyson, 1970). The slender, elongate form and fimbriated antennal segments are also characters of generic value. Subgenera were proposed by Casey (1913:355) but he failed to define them. This treatment of the genus will include the subgenera.

The members of the genus have apparently evolved toward an apterous state. Of those species covered in this paper, only *filum s. str.* and *filum costulatum* have and utilize fully developed wings. Other species such as *lobata* (a Mexican species) and *filum brevialatum* n. ssp. have abbreviated hind wings. Members of the subgenus *Euthuorus,* such as *macra* n. sp., *ornatipennis,* and the Central American *variegata,* have only slender filaments. All examined members of the subgenus *Spalacopsis* have only small pads or slender filaments and the elytra are fused along the suture.

Sexual dimorphism occurs only in 2 species of those covered (*macra* n. sp. and *ornatipennis,* both of Jamaica). In these 2 species the form and/or pubescence of the apices of the elytra differ in each sex. Sexing specimens has presented problems in the past (Casey 1913:357). The abdomen, viewed from the rear, shows the 8th tergite protruding from the anal opening (Fig. 13) in the male. It is reduced and not protruding in the female (Fig. 10). In most cases the abdomen of the male is thinner and each segment is slightly constricted.

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*Presently with the California Department of Food and Agriculture, Control and Eradication, Curly-Top Virus Control Project, 2550 Mariposa St., Fresno, CA 93721.

Male terminalia of most species were examined but no distinctive characters were found.

There is no published information on the biology of this genus. Craighead (1923:134) briefly described the larva of *Spalacopsis stolata* and recorded the host as Jerusalem oak (*Chenopodium botrys*). Hamilton (*in* Leng & Hamilton, 1896:145) recorded *Melothria pendula* as the host of *filum costulatum*. T. H. Farr (Institute of Jamaica, per. com.) stated that *filum s. str.* is almost always beaten from tangles of vines (*Ipomoea* sp.), and that he has reared a single specimen from this plant. Specimens of *Spalacopsis (E.) filum costulatum* Casey were beaten from the vine *Calonyctium aculeatum,* also a member of the family Convolvulaceae, in southern Florida. Most of the apterous species are taken by beating vegetation, but several specimens have been taken at light.

Although the genus has been partially or wholly reviewed (Casey, 1913; Breuning, 1962), both authors failed to check the appropriate types. This has led to much confusion in the validity of names and the correct placement of synonyms. The great amount of variation within each species can easily cause confusion. Original describers often did not describe salient characters needed for separating their form from other described species.

Types of the following species have been examined (those with asterisks were by a photo only). *Spalacopsis confusa* Casey; *costulata* Casey; *exilis* Casey; *fusca* Gahan*; *grandis* Chevrolat*; *howdeni* Tyson; *lobata* Breuning*; *ornatipennis* Fisher; *pertenuis* Casey; *phantasma* Bates*; *protensa* Pasco*; *scapalis* Casey; *similis* Gahan*; *spinipennis* Fisher; *stolata* Newman; *suffusa* Newman; *suturalis* Hamilton; *texana* Casey; and *variegata* Bates*.

SPALACOPSIS NEWMAN

Spalacopsis Newman, 1842:303,305; Agassiz, 1846:150; Melsheimer, 1853:110; Thomson, 1860:366; Lacordaire, 1872:704; Bates, 1880:129; LeConte & Horn, 1883:330; Henshaw, 1885:104; Leng & Hamilton, 1896:146; Casey, 1913:354; Aurivillius, 1922:361; Breuning, 1962:41; Arnett, 1968:893; Tyson, 1970:484.
Eutheia Guerin, 1844:247; Pasco, 1858:264; Lacordaire, 1872:704.
Spacalopsis LeConte, 1852:145 (lapsus for *Spalacopsis*).
Systene Pasco, 1858:264.

Type Species: *Spalacopsis stolata* Newman.

Body elongate and subcylindrical. **Head:** antennae arising from distal, dorsal margins, as long as body or slightly longer, bases approximate, scape robust and elongate, reaching to basal half of pronotum, distal segments with few to many mostly straight hairs (*Spalacopsis s. str.*) or with many hairs sinuate (*Euthuorus*); eyes oval to slightly quadrate, not emarginate nor divided, usually with 1 to 3 sensory setae about the region of the eye; mouthparts at ventral, basal area of head, maxillary palpi approximately twice the length of labial palpi. **Thorax:** subcylindrical, usually as long or longer than head, disc with a linear, median, polished callus; prosternum abbreviated at sides for reception of mouthparts when head in repose, prosternal process greatly expanded behind coxae. **Elytra:** free with wings fully developed, abbreviated, or reduced to filaments (*Euthurous),* or elytra fused along the suture with wings reduced to pads or filaments (*Spalacopsis s. str.*), apices

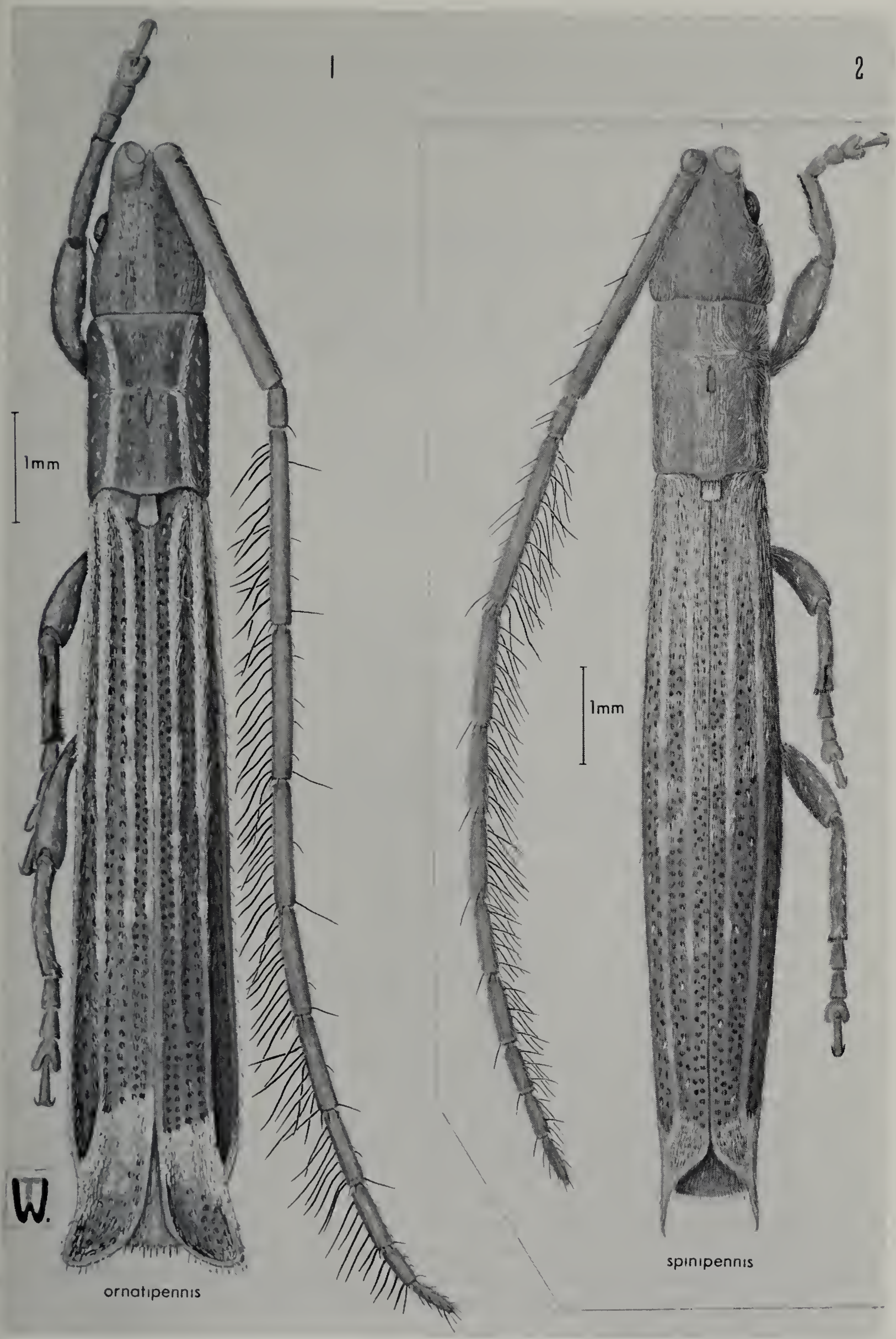

Fig. 1. *Spalacopsis (Euthuorus) ornatipennis* Fisher, female; 2. *Spalacopsis (E.) spinipennis* Fisher, female.

tapering and usually asymmetrical (*Spalacopsis s. str.*) or lobed, declivous, spiniform, diverging, or infrequently tapering (*Euthuorus*). **Legs:** short, femora clavate, fore and mid tibiae usually with a dorsal sinus which is margined with a comb of stout spines, fore tibia with a small tooth on apical mesal margin, tarsi spongy beneath, third segment cleft nearly to base, tarsal claws divergent.

KEY TO THE *SCALACOPSIS* OF THE WEST INDIES AND AMERICA NORTH OF MEXICO*

1. Elytra with suture not fused, apex usually as wide or wider than middle, apices spiniform, lobate, broadly rounded or tapering; species alate or apterous .... Subgenus *Euthuorus* 2

1′. Elytra with suture fused, apex narrower than middle, apices tapering, slightly divergent and usually asymmetrical; apterous .... Subgenus *Spalacopsis s. str.* 7

2(1). Elytral pubescence largely variegated with a preapical or apical oblique or transverse light colored band or line; apterous 3

2′. Elytral pubescence uniform or, if variegated, without an apical or preapical band, line, or group of spots; alate or apterous 5

3(2). Elytral apices broadly rounded or slightly produced, not spinose; Jamaica 4

3′. Elytral apices spinose; Cuba .... *spinipennis* Fisher

4(3). Elytra with a white preapical band (female) or with apices dark and margined with an oblique white line (male); scutellum rounded at apex .... *ornatipennis* Fisher

4′. Elytra with apices light colored; scutellum triangular, apex acute .... *macra* n. sp. (female)

5(2). Elytra parallel sided, not inflated medially; alate; scutellum broadly rounded apically 6

5′. Elytra noticeably inflated medially; apices broadly, separately rounded; scutellum triangular; apterous .... *macra* n. sp. (male)

6(5). Integument of ventral surface, femora, and head piceous; pubescence mostly greyish; denuded areas of elytra usually expanded and lineate; West Indies .... *filum filum* (Klug)

6′. Integument light reddish-brown to brown, mostly covered by dense yellow or yellow-grey pubescence; denuded areas of elytra usually as ovoid spots on the apical half; Florida .... *filum costulatum* Casey

6″. Integument brown; denuded areas of elytra greatly expanded, pubescence restricted to irregular patches; apices tapering and somewhat pointed, not declivous; hind wings 0.5 the length of the abdomen; Dominican Republic .... *filum brevialatum* n. ssp.

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*Because of the intraspecific variation and the poor condition of many of the specimens, usually only 70-80% of those examined will successfully key out. In some cases the collection locality is the best means for separation.

7(1). Head and scape with pubescence sparse to moderately dense, not obscuring surface 8
7′. Head and scape with pubescence dense, surface for the most part obscured; eastern Florida .... *stolata* Newman

8(7). Elytra uniformly pubescent, either sparsely or densely so 10
8′. Elytra with denuded areas and areas of condensed pubescence 9

9(8). Integument reddish-brown to brown; elytra with sutural area and costal intervals partially denuded, lateral margins usually densely yellow-grey pubescent; western Florida .... *suffusa* Newman
9′. Integument dark brown; elytra with small condensed areas of white pubescence on the discal costae; lateral margins usually without dense yellow-grey pubescence; coastal Texas .... *texana* Casey

10(8). Elytra densely, uniformly grey pubescent; Puerto Rico .... *unicolor* n. sp.
10′. Elytra sparsely and uniformly grey pubescent; Florida .... *chemsaki* n. sp.

SUBGENUS *Euthuorus*

Euthuorus Duval, 1857 (*in* Sagra):276; Chevrolat, 1862:255; Casey, 1913:355.

TYPE SPECIES: *Euthuorus filum,* Duval

Individuals of this subgenus are extremely variable in elytral configuration but always have the elytra free, not fused along the suture. The flight wings vary from fully developed to small filaments.

Spalacopsis (Euthuorus) filum filum (Klug)
(Fig. 8, 16)

Hippopsis filum Klug, 1829:13.
Euthuorus filum, Duval, 1857 (*in* Sagra): 276; Chevrolat, 1862:256.
Eutheia filum, Lacodaire, 1872:704.
Spalacopsis linum, Leng & Hamilton, 1896:145 (in part, lapsus for *filum*).
Spalacopsis filum, Blatchley, 1920:96 (in part); Aurivillius, 1922:361; Casey, 1924:293 (in part); Wolcott, 1948:341; Breuning, 1962:43.

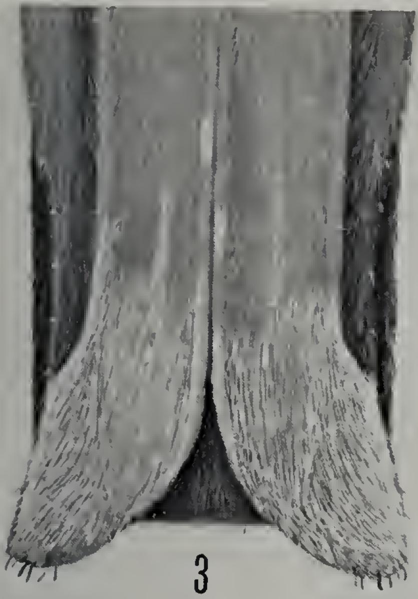
MALE: Head as long as pronotum, densely covered with greyish-brown pubescence; antennae as long as or surpassing elytral apex by 1 segment, segments from 3rd densely fimbriated with strongly sinuate hairs, scape elongate, reaching to middle of pronotum. Pronotum densely covered with greyish pubescence which obscures all of integument except small polished callus on the middle of disc, both head and pronotum with lateral and a medial longitudinal whitish line. Scutellum slightly elongate, parallel sided and rounded at apex, densely covered with whitish pubescence. Elytra parallel sided, approximately 5 times as long as wide, apex abruptly declivous; pubescence greyish to yellow-grey with small patches of whitish hairs on the discal costae and brownish hairs in denuded areas, denuded areas variable and prominent on apical fourth but expanded to base and coalesced into linear lines on many specimens. Underside densely covered with greyish-brown pubescence, abdominal sternites each with 2 sensory setae located at middle of segment on either side of mid line, segments usually slightly constricted, 8th tergite with apex truncate. Length: 5 to 10mm.

FEMALE. Similar to male but averaging larger in size; denuded areas of elytra less prominent, abdominal segments usually not constricted. Length, 5 to 10mm.

TYPE: CUBA. The location of the type is unknown to me.

MATERIAL EXAMINED. BAHAMA ISLANDS: Great Inagua Isl., Matthewtown, 31-I-1953, E. B. Hayden, G. B. Rabb, 1 male; Berry Islands, Fraziers Hog Cay, 30-IV-1953, E. B. Hayden, 1 male; South Binimi Isl., V-VI-1951, Gertsch & Cazier, 2 males, 4 females. HAITI: Port Au Prince, 1899, R. J. Crew, 1 female; Aux Cayes, 3-III-1898, E. A. Klages, 2 females; Williamson, 24-V-1930, H. L. Dozier, 1 male. CUBA: Cayamas, 23-I, 11-III, 28-V, E. A. Schwarz, 4 males, 1 female; Havana, 21-28-V, Wickham, 1 male; Caonao, VI-1923, Zavas, 1 female. JAMAICA: *Trelawny*: Barbecue Bottom, 5-X-1959, T. H. Farr, 1 male, 1 female; Duncans, 13-25-VIII-1966, Howden & Becker, 3 males, 6 females; 2m W. Duncans, 16-VII-1959, T. H. Farr, 1 female; 2m W. Duncans, 25-XI-1959, T. H. Farr, 1 female; 5m W. Duncans, 3-II-1960, T. H. Farr, 1 female. *Portland*: Long Bay, 13-VIII-1959, T. H. Farr, 2 females; 2m S. Long Bay, 13-VIII-1959, T. H. Farr, 1 female. *Clarendon*: Salt River, 6-XII-1959, T. H. Farr, 1 male, 1 female; 2m N. Milk River, 19-XI-1959, T. H. Farr, 1 female; 2m E. Portland Cottage, 26-VIII-1959, T. H. Farr, 1 male; 3m N. May Pen, 18-VII-1959, T. H. Farr, 2 males; 1/2m E. Portland Cottage, 10-I-1960, ex. *Jaquemontia pentantha,* T. H. Farr, 1 male. *Westmorland*: 1m E. Savanna-la-Mar, 14,16-IX-1959, T. H. Farr, 2 females; 3m S. Glasgow, 16-IX-1959, T. H. Farr, 2 males; 2m S. Glasgow, 16-IX-1959, T. H. Farr, 1 male, 1 female; 2m W. Whitehouse, 16-IX-1959, T. H. Farr, 1 male, 1 female. *Hanover*: lucea, 15-VII-1959, T. H. Farr, 2 males; Lucea, 21-VII-1960, T. H. Farr, 2 females; 1/2m W. Hopewell, 21-XI-1959, T. H. Farr, 4 males. *St. Andrew*: Stony Hill, 25-VII-1966, H. Howden, 1 female; Hermitage Rd., 12-VII-1959, T. H. Farr, 1 male, 4 females; Hermitage Rd., 26-XI-1961, T. H. Farr, 1 female; Hermitage Rd., 11-XII-1960, T. H. Farr, ex. *Metastelma* sp., 2 males, 1 female; Dam Rd., 11-X-1959, T. H. Farr, 1 male; Clydesdale to Morces Gap, 8-VIII-1959, T. H. Farr, 1 male; Ferry, 19-II-1961, T. H. Farr, 1 male; Long Mt., 14-II-1960, T. H. Farr, 1 female. *St. Catherine*: Guanaboa Vale, 9-VIII-1964, T. H. Farr, 1 male, 2 females. *St. James*: 3m W. Flamingo, 19-VIII-1966, Howden & Becker, 1 female; 10m E. Montego, 3-II-1960, T. H. Farr, 2 females. *St. Elizabeth*: Goshen, 16-IX-1959, T. H. Farr, 1 male; Goshen, 27-VI-1959, T. H. Farr, 1 female; Munro, 5-III-1961, T. H. Farr, 1 female; Scotts Cove, 15-IX-1959, T. H. Farr, 1 female. *St. Ann*: Discovery Bay, 13-VII-1963, T. H. Farr, 1 female. *St. Thomas*: Morant Pt., 20-XII-1959, T. H. Farr, 3 males, 1 female; Morant Pt., 8-XI-1959, T. H. Farr, 3 males, 5 females; Morant Pt., 27-VI-1959, T. H. Farr, 1 male, 1 female; 12m E. Kingston, 1-I-1960, T. H. Farr, 1 female; 12m E. Kingston, 6-III-1960, T. H. Farr, 1 female; 12m E. Kingston, 29-XI-1959, T. H. Farr, 1 male, 1 female; 12m E. Kingston, 13-XII-1959, T. H. Farr, 1 male; 14 1/2m E. Kingston, 19-XI-1961, T. H. Farr, 1 female; 14 1/2m E. Kingston, 22-V-1960, T. H. Farr, 1 male; 16m E. Kingston, 9-VIII-1959, T. H. Farr, 2 males, 1 female; 17m E. Kingston, 6-IX-1959, T. H. Farr, 3 males, 2 females; 17m E. Kingston, 25-X-1959, T. H. Farr, 1 male, 1 female; Kingston region, IV-1906, Van Duzee, 1 male. *Manchester*:nr. Goshen, 16-IX-1959, T. H. Farr, 1 male. PUERTO RICO: Guajataca, 8-II-1969, L. & C. W. O'Brien, 1 male.

This species is extremely variable in both size and amount of pubescence on the elytra. The specimens examined from Haiti and Puerto Rico are more



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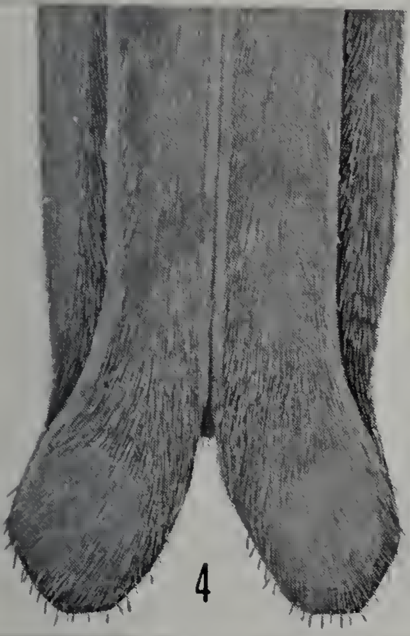

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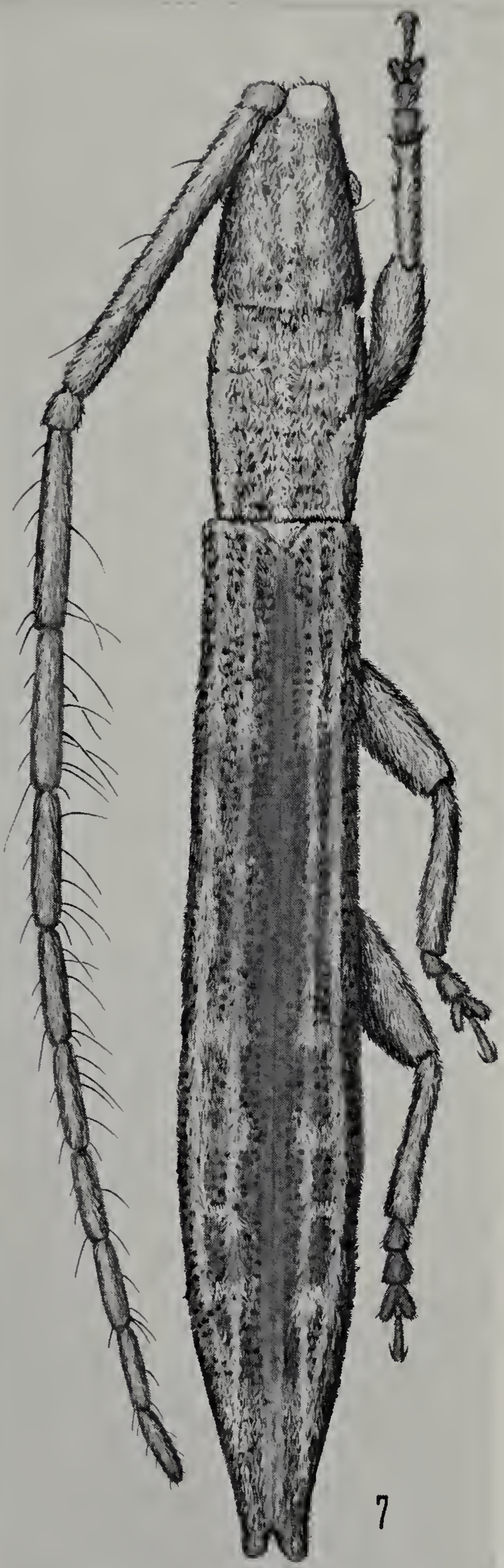

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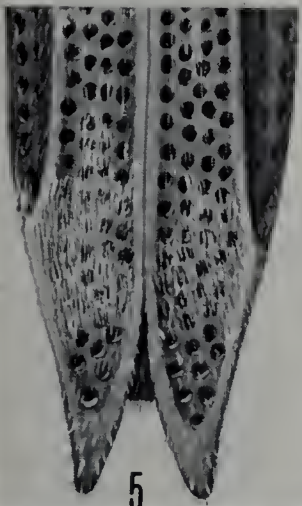

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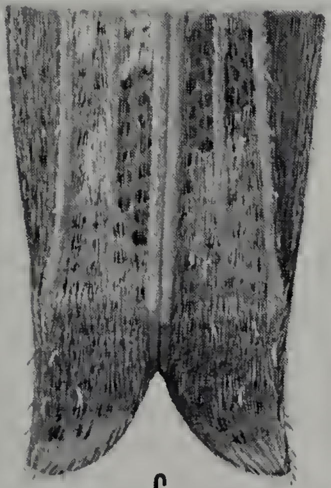

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Fig. 3-4: *Spalacopsis (Euthuorus) macra,* n. sp. 3) dorsal view of elytral apex, female; 4) same view, male. Fig. 5: *Spalacopsis (E.) filum brevialatum,* n. spp., same view, male. Fig. 6: *Spalacopsis (E.) filum costulatum* Casey, same view, male. Fig. 7: *Spalacopsis (Spalacopsis) stolata* Newman, dorsal habitus, female.

maculate and have the elytral apex slightly tapering rather than declivous. Additional material from the areas mentioned above may prove this form to be distinct.

Spalacopsis (Euthuorus) filum costulatum Casey, New Combination.
(Fig. 6,9,10,11,16)

Spalacopsis filum, Aurivillius, 1922:361 (in part).
Spalacopsis linum, Leng & Hamilton, 1896:145 (in part, lapsus for *filum*).
Spalacopsis scapalis Casey, 1913:355; Aurivillius, 1922:361. New Synonymy.
Spalacopsis filum, m. *scapalis,* Breuning, 1962:44.
Spalacopsis confusa Casey, 1924:293. New Synonymy.
Spalacopsis costulata Casey, 1913:355; Aurivillius, 1922:361.

MALE: Integument reddish-brown to brown, pubescence yellow to yellow-grey with denuded areas of the elytra reduced basally, usually numerous only on the apical half of elytra and mostly ovoid in shape. Specimens examined averaged 1 to 3mm larger than *filum s. str.* Length: 5 to 13mm.

FEMALE: As in the male the denuded areas are restricted, the integument lighter in color, and individuals are larger than *filum s. str.* Length: 6 to 14mm.

TYPE: Holotype male, Florida, Biscayne Bay, E. A. Schwarz, Casey Collection (USNM); of *scapalis,* Florida, Palm Beach, Casey Collection (USNM); of *confusa,* Florida, Cape Sable, W. S. Blatchley, Casey Collection (USNM).

MATERIAL EXAMINED: Florida: *Dade Co.*: Coral Gables, 20-VI-1965, L. & C. W. O'Brien, 1 male, 1 female; Matheson Hammock, 11-IV-1951, H. & A. Howden, 1 female; Miami, 10-IV-1962, J. N. Todd, 1 female; Miami, 5-V, D. M. Castle, 5 males, 5 females; Miami, 3-IV, J. N. Knull, 1 male; Miami, III-1912, G. M. Green, 1 male; Miami, 5-III-1956, L. J. Daigle, 1 female; Miami, Hubbard & Schwarz, 1 female; Biscayne, 27-IV to 28-V, Hubbard & Schwarz, 12 males, 17 females; Biscayne Bay, E. A. Schwarz, 2 males; Biscayne Bay, A. T. Slosson, 1 male; Homestead, 4-IV-1952, J. P. Vockeroth, 1 male; Homestead, 5-III-1957, R. W. Swanson, 1 female; Paradise Key, 24-II-1919, 1 female; Paradise Key, II-1927, 1 female; Paradise Key, 29-III-1952, J. P. Vockeroth, 2 males. *Monroe Co.*: Key West, IV, Hubbard & Schwarz, 1 male; Key West, 18-III-1912, E. A. Schwarz, 1 female; Key West, 4 females; Key Largo, 5 females; Key Largo, 14-IX-1911, 1 male; Key Largo, 26-II-1919, 1 male; Key Largo, 5 males, 6 females; Key Largo Key, 3-IV-1966, H. V. Weems, 3 males; Key Largo Key, 1-I-1967, H. V. Weems, 1 male; Key Largo Key, 6-VI-1960, H. V. Weems, 1 female; Key Largo Key, 7-X II-1966, Woodruff & Knowles, 1 female; Key Largo Key, 26-II-1956, R. A. Morse, 1 male; Key Largo Key, 26-XII-1954, C. Weems, 1 female; Long Key, 28-III-1957, H. V. Weems, 1 male; L. Matecumbe Key, 31-III-1952, J. P. Vockeroth, 1 female; Summerland Key, 21-I-1933, C. F. Rainwater, 1 female; Marathon, 7-8-III-1919, E. A. Schwarz, 1 female; Plantation Key, 3-V-1952, H. V. Weems, 1 male, 1 female; Palma Vista Hammock, 1-XII-1961, Messenger, Hurd & Smith, 1 female; Flamingo, Everglades N.P., 4-II-1967, D. E. Bright, 1 female; Flamingo, Everglades N.P., 29-XI-1970, beating *Calonyctium aculeatum,* C. W. O'Brien, 2 males, 3 females; Cape Sable, 11-III-1960, J. L. Weaver, 1 female; Cape Sable, 1 male. *Collier Co.*: Marco, 9-IV-1912, 3 females. *Martin Co.*: Jupiter, 2-IV, Hubbard & Schwarz, 1 male; Jupiter, 24-IV, Hubbard & Schwarz, 1 male, 1 female. *Palm Beach Co.*: Lake Worth, Hubbard & Schwarz, 2 females; Lake Worth, 6-V, 1 male. *Osceola Co.*: Kissimmee, C. Palm, 3 males, 2 females. *Volusia Co.*: Enterprise, 14-V, D. M. Castle, 2 females; Enterprise, 14-VII, D. M. Castle, 1 female. Additional Florida material: Trail City, 7-IV-1952, O. Peck, 1 female.

The separation of this form and *filum s. str.* may sometimes be a difficult task. Of all the specimens of *filum* examined, *costulatum* ranges to a much larger size, average 2 to 3mm larger, has the pubescence yellowish rather than greyish, and has fewer denuded areas on the elytra. The smallest individuals of this form from the Florida Keys and the tip of mainland Florida tend to intergrade with *filum s. str.* Because of this, distribution may be the best means of separation on atypical and smaller specimens. Much more material from Cuba is needed before this complex can be fully understood. Casey's *scapalis* and *confusa* are heavily maculate specimens of *costulatum*. His name *costulata* is here emended to agree in gender with *filum*.

Spalacopsis (Euthuorus) filum brevialatum Tyson, NEW SUBSPECIES
(Fig. 5)

MALE: Antennae as in *filum s. str.*, fimbriated from second segment, fimbriations greatly sinuated; head as long as pronotum, punctation confused, easily seen through reduced pubescence, separated by at least their diameters. Pronotum densely pubescent at middle in a wide longitudinal line enclosing the small linear callus. Scutellum rounded at apex and densely pubescent. Elytra as described for *filum s. str.* but pubescence reduced to irregular blotches and tapered apices not declivous; hind wings 0.5 the length of the elytra. Underside as in *filum s. str.* Length: 9mm.

FEMALE: Unknown.

TYPE: Holotype male, DOMINICAN REPUBLIC: Samana Bay, Bosco del Infierno, 9-III-1928, G. S. Miller (USNM).

Structurally this form is similar to *filum s. str.*, but the tapered elytral apices, reduced hind wings, and the overall reduced pubescence will separate them. Only the type is known.

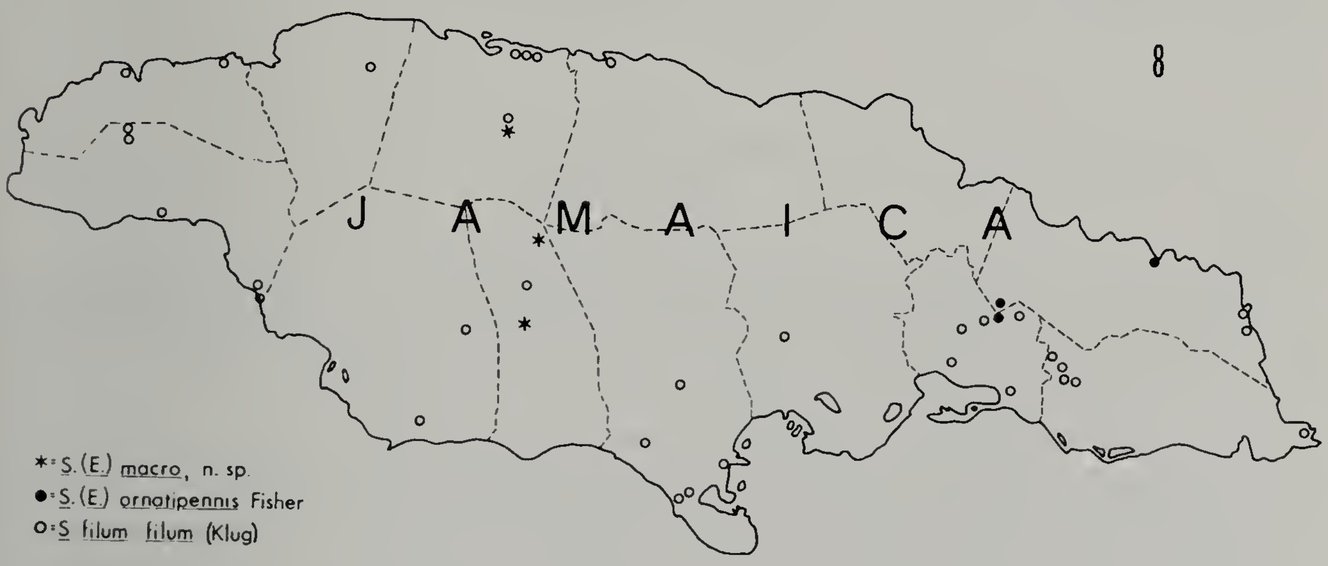

Fig. 8: Known distribution of the Jamaican species of *Spalacopsis*.

Spalacopsis (Euthuorus) ornatipennis Fisher
(Fig. 1,4)

Spalacopsis ornatipennis Fisher, 1935:200; Breuning, 1962:47.

MALE: Antennae longer than body by 2 segments, fimbriated beginning with segment 3; head slightly shorter than pronotum, densely covered with appressed ashy and grey-brown pubescence. Prothorax cylindrical, parallel sided with middle of disc concave, surface irregularly punctate, densely covered with grey-brown pubescence except for very thin medial callus; both head and pronotum with vague dorso-lateral and a medial, longitudinal lighter line. Scutellum elongate with apex rotundo-truncate and densely pubescent, whitish at base and blending to light ashy-brown at apex. Elytra at base as wide as pronotum, gradually widening to apex, generally covered with ashy pubescence, costae strongly elevated, basally with lighter pubescence which darkens near middle; apex margined with a thin, irregular, oblique whitish line, apices separately rounded and dark pubescent; hind wings reduced to filaments. Underside with integument piceous and covered with ashy-brown pubescence except for sterna which are ashy pubescent and have a median whitish line on sterna 2 to 4. Length: 7 1/2 to 11mm.

FEMALE: Very similar to male but with longitudinal lines of pubescence on pronotum more strongly evident. Elytra with basal half with whitish pubescence on costae and a wide, irregular, oblique whitish band above apices. Scutellum darker at base, whitish at apex. Underside lighter, sterna with median white lines joined to form a continuous line. Length: 10 1/2mm.

TYPE: Holotype female, JAMAICA: Mandeville, 1-4-IV-1906, E. P. Van Duzee (USNM).

MATERIAL EXAMINED: JAMAICA: *Manchester*: Christiana, 11-VI-1959, T. H. Farr, 2 males. *Trelawny*: Barbecue Bottom, 12-VII-1969, H. F. Howden, 2 males.

The sexual dimorphism exhibited by this species in its pubescent patterns makes identification difficult. The slightly lobed elytra apices places it in a group with *filum, macra* n. sp., and *lobata* of southern Mexico. The rotundo-truncate scutellar apex will separate this form from *macra,* and the ornamented elytra will separate it from *filum,* a smaller and more somber colored species.

Spalacopsis (Euthuorus) spinipennis Fisher
(Fig. 2)

Spalacopsis spinipennis Fisher, 1936:347; Breuning, 1962:47.

FEMALE: "Slender, moderately convex above, uniformly reddish brown, the antennal joints slightly paler at bases, and densely clothed with very short, whitish and dark brown pubescence. Head beneath sparsely, coarsely punctate, rather densely clothed with moderately long, curly, whitish hairs; above sparsely, coarsely, punctate, rather densely, irregularly clothed with short, recumbent, brownish yellow hairs. Antenna about as long as the body, rather densely clothed with short, semierect, whitish and yellowish hairs intermixed, and densely ciliate beneath with long, flying, black hairs. Pronotum one-half longer than wide, subequal in width at base and apex, subcylindrical; sides feebly sinuate; parallel; disc stringly convex; surface coarsely, sparsely, irregularly punctate, densely, irregularly clothed with long,

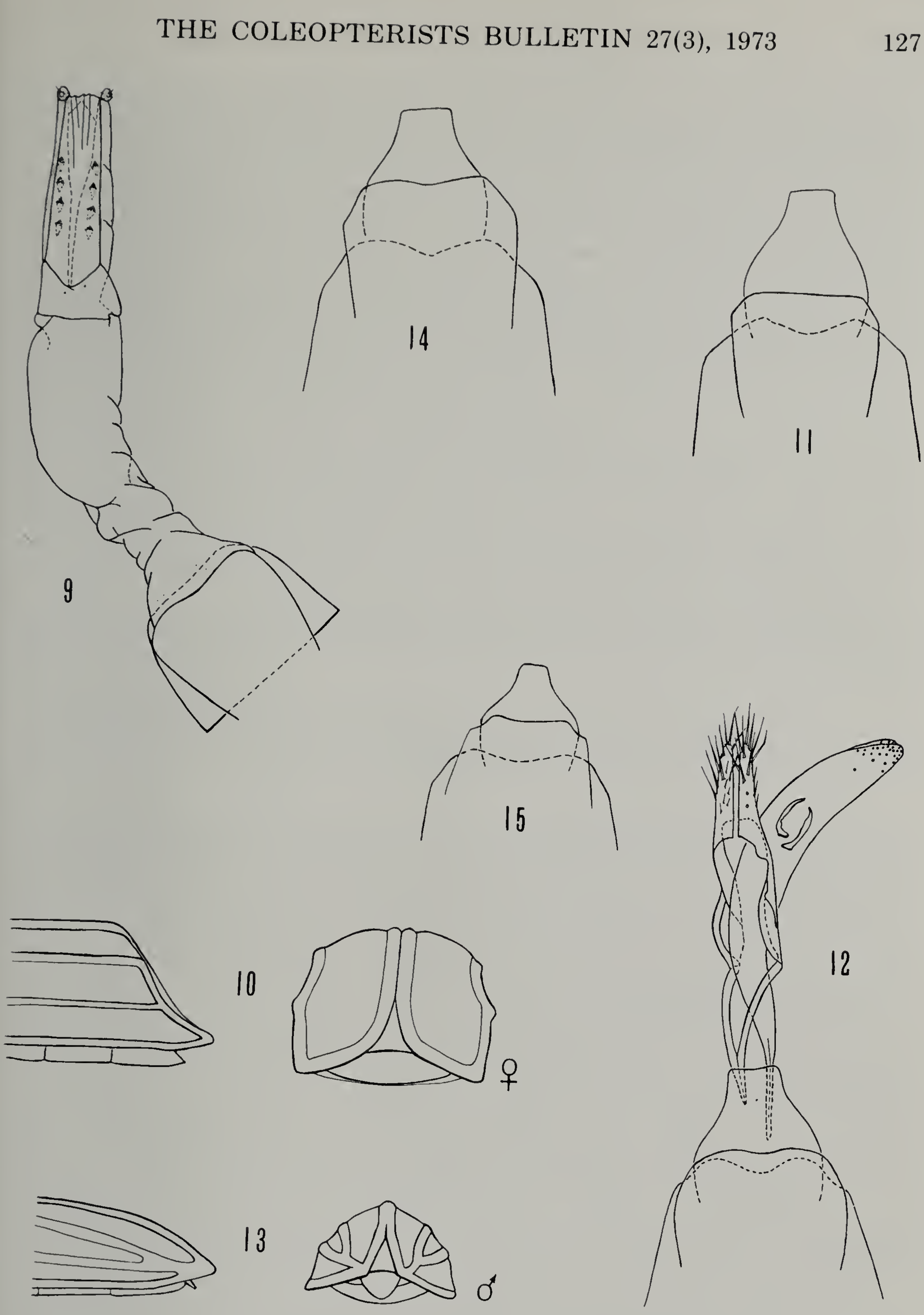

Fig. 9-11: *Spalacopsis (Euthuorus) filum costulatum* Casey: 9) dorsal view of female terminalia; 10) lateral and terminal view of elytral apex, female; 11) dorsal view of male abdominal apex. Fig. 12: *Spalacopsis (Spalacopsis) suffusa* Newman, dorsal view of male terminalia. Fig. 13: *Spalacopsis (S.) chemsaki*, n. sp., lateral and terminal view of elytral apex, male. Fig. 14: *Spalacopsis (S.) stolata* Newman, dorsal view of male abdominal apex. Fig. 15: *Spalacopsis (S.) texana* Casey, same view.

recumbent, whitish and brownish white hairs intermixed, and with a small, oblong, median, glabrous spot. Scutellum quadrate, densely clothed with recumbent, whitish pubescence. Elytra four times as long as pronotum, at base as wide as pronotum; sides obliquely expanded from base to near the middle, then parallel to the tips, which are separately obliquely truncate, with a long, acute spine at outer angles; disc moderately convex, each elytron with three more or less distinct, irregular, longitudinal costae, not including the sutural margin; surface finely, rather densely, irregularly punctate (the punctures arranged in more or less distinct rows basally), sparsely, irregularly clothed with short, recumbent, whitish and brownish pubescence, the whitish pubescence predominating on basal halves, and at apices where it is denser. Body beneath finely, sparsely, irregularly punctate, rather densely, irregularly clothed with moderately long, recumbent, whitish and brownish-white hairs intermixed, the pubescence more uniformly whitish, longer, and curly on the prosternum; last abdominal segment broadly subtruncate or feebly emarginate at apex. Length, 14mm." (Original description).

TYPE: Holotype female, CUBA: Oriente Province, Turquino Peak Region, 10-29-VI-1936, J. Acuña (USNM). The only specimen seen.

This species differs from all members of the genus by the spinose elytral apices.

Spalacopsis (Euthuorus) macra Tyson, NEW SPECIES
(Fig. 3,4,8)

MALE: General color ashy-grey without contrasting ornamentation. Antennae as long as body or slightly longer, moderately fimbriated beginning with segment 3, scape reaching middle of pronotum and clothed with dense, appressed pubescence that obscures the brown integument. Head as long as pronotum, densely covered with ashy-grey pubescence, a faint, lighter colored, longitudinal line is noticeable at middle; surface irregularly punctate throughout, though hidden by dense, appressed pubescence. Prothorax cylindrical but disc flat and slightly concave at middle, callus small and ovoid, at middle of disc; surface irregularly punctate, punctures hidden by pubescence. Scutellum elongate triangular and acute at apex, densely covered with light ashy pubescence. Elytra about as wide as pronotum at base, becoming wider toward middle then slightly tapering to apex, apices moderately produced, separately rounded and shallowly concave; elytral surface, except for a few denuded areas on apical half, densely covered with ashy, brown and light ashy pubescence, any ornamentation vague; hind wings reduced to filaments. Underside with integument dark brown, densely pubescent, sterna 1 to 4 with medio-apical area with lighter pubescence. Length: 10 to 18mm.

FEMALE: Similar to male but differs by the more contrasting general coloration. Most specimens have the apices of elytra lighter in color and less strongly produced, though concave as in male. Length: 7 to 22mm.

TYPE: Holotype female, allotype male: JAMAICA, *St. Andrews,* Hardwar Gap, 4,000′, 25-VII-1966, Howden & Becker (CNCI). Paratypes: 23 specimens as follows: JAMAICA, *St. Andrews*: same data as type, 3-29-VII-1966, Howden & Becker, 8 males, 4 females (CNCI); same data as type, 10-VI-1961, T. H. Farr, 1 female (IJSM); same data as type, 3-I-1960, T. H. Farr, 1 male (IJSM). *Portland:* Port Antonio, 1-7-VIII-1966, Howden & Becker, 2 females (CNCI); Hardwar Gap, VI-1967, T. H. Farr, 2 females (IJSM); same data, VII-1967, T. H. Farr, 1 female (IJSM); same data, VIII-1967, T. H. Farr, 1 female (IJSM);

same data, 19-VI-1968, T. H. Farr, 1 male (IJSM); same data, 28-VI-1959, T. H. Farr, 1 male (IJSM); same data, 16-VIII-1967, T. H. Farr, 1 male (IJSM).

This species is basically similar to *ornatipennis* but its larger size and pointed scutellar apex will separate them. The sexual dimorphism, found only in this species and *ornatipennis,* as well as variations in color and color patterns, help to confuse the 2 species, but they are easily separated on the above characters. *Spalacopsis macra* is apparently restricted to the north-central region of Jamaica (see Fig. 8). Specimens of this species have proven to be the largest recorded for the genus. One paratype from the Institute of Jamaica has been placed in the United States National Museum.

INCERTAE SEDIS

Spalacopsis (Euthuorus) grandis (Chevrolat)

Euthuorus grandis Chevrolat, 1862:255.
Spalacopsis grandis, Aurivillius, 1922:361; Breuning, 1962:46.

TYPE: Type locality: CUBA.

I have seen a photo of Chevrolat's type. In general form and coloration it appears to be but a large individual of *filum* (Klug). However, until the type of *filum* and topotypic specimens of *grandis* are examined, I cannot validate or synonymize this species.

Breuning (1962:46) synonymized *lobata* Breuning under *grandis.* I have seen a photo of Breuning's type, and it is more closely related to *macra* than

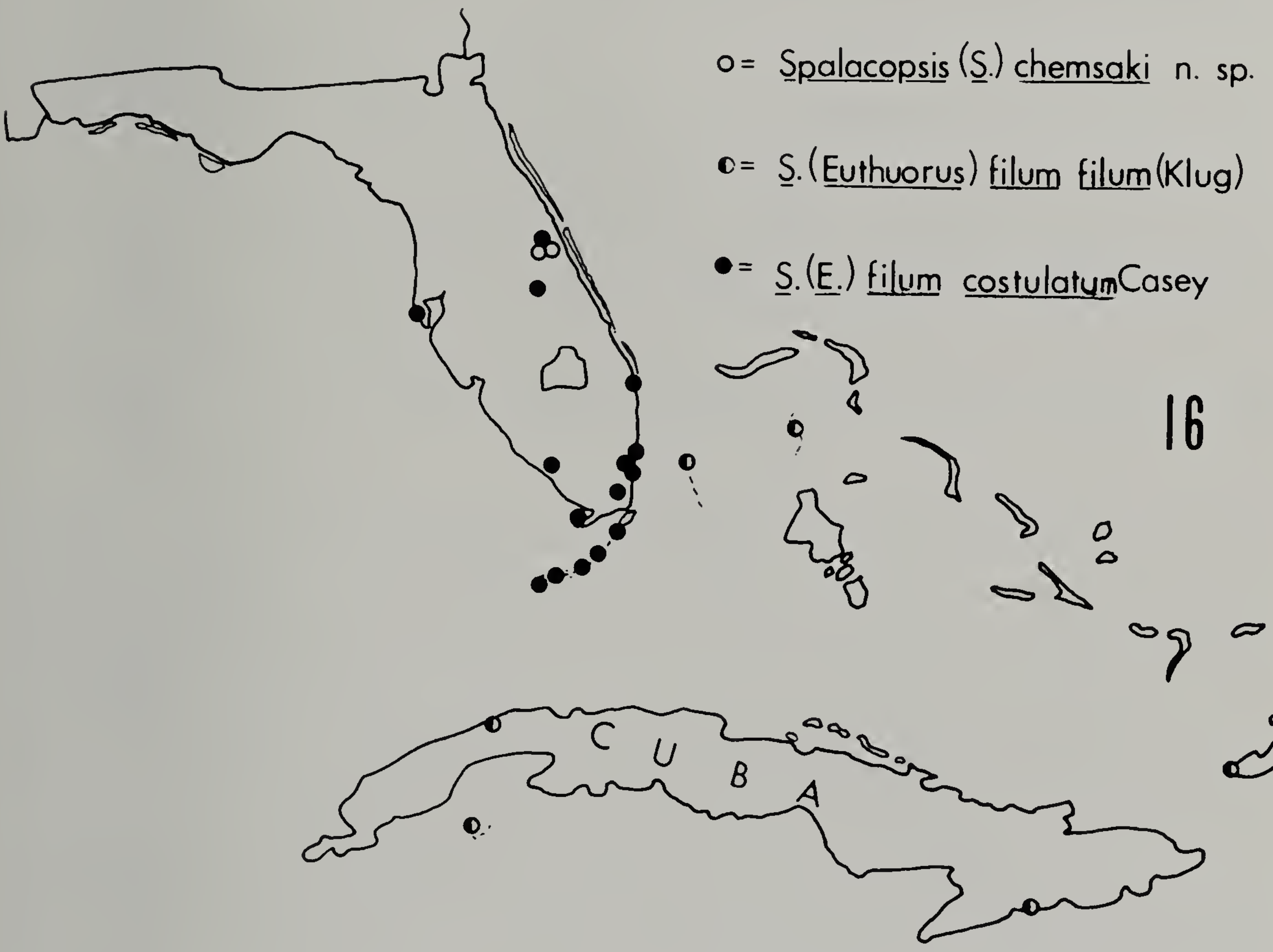
○= Spalacopsis (S.) chemsaki n. sp.
◐= S. (Euthuorus) filum filum (Klug)
●= S. (E.) filum costulatum Casey
16
C U B A

Fig. 16: Known distribution of *Spalacopsis (S.) chemsaki,* n. sp., and *Spalacopsis (E.) filum costulatum* Casey, in Florida, and *Spalacopsis (E.) filum filum* (Klug) in the Bahama Islands and Cuba.

grandis. Because *lobata* has the hind wings partially abbreviated (*grandis* has fully developed hind wings and *macra* has them reduced to filaments), and the type locality is Mexico, I feel *lobata* Breuning should be resurrected from synonymy.

SUBGENUS *Spalacopsis s. str.*

Spalacopsis, Casey, 1913:355.

TYPE SPECIES: *Spalacopsis stolata* Newman.

As mentioned under the generic description, all members of this subgenus have the elytra fused along the suture and the hind wings greatly reduced. Also, they all have the apices of the elytra tapering and slightly asymmetrical, as well as having the fimbriated antennal segments with fewer and less sinuated hairs.

Spalacopsis (s. str.) chemsaki Tyson, NEW SPECIES
(Fig. 13,16)

Spalacopsis suffusa, LeConte, 1852:145; Lacordaire, 1872:704 (in part); Horn, 1885:9 (in part); Leng & Hamilton, 1896:145; Casey, 1913:356; Breuning, 1962:45.

MALE: Integumental color brown to fulvous-brown, underside darker; pubescence sparse and uniform grey, occasionally with irregular lighter dashes

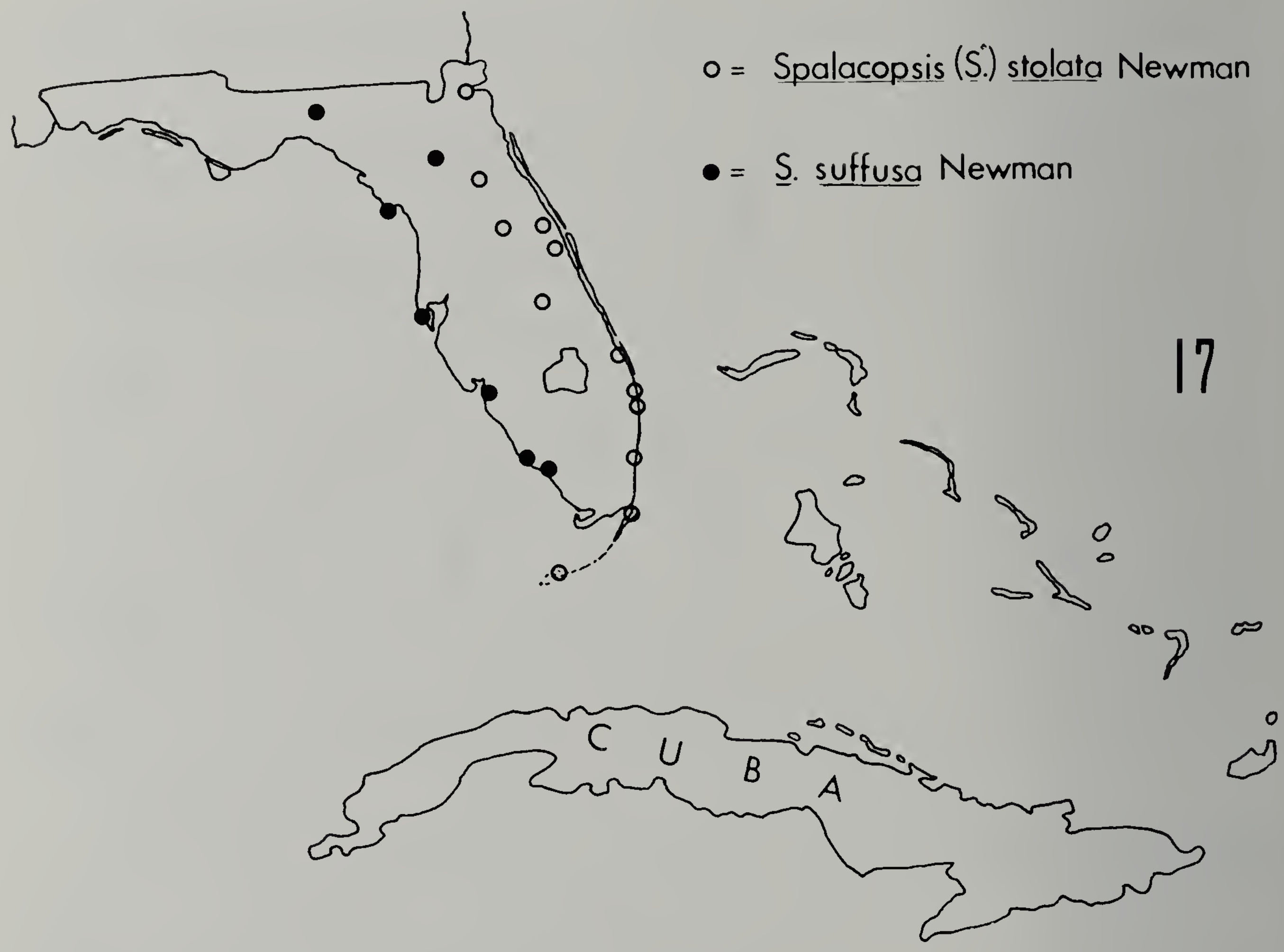

Fig. 17: Known distribution in Florida of *Spalacopsis (S.) stolata* Newman, and *S. (S.) suffusa* Newman.

on elytral costae. Head elongate, longer or as long as pronotum; antennae moderately fimbriated beginning with segment 4, eyes small, lateral, punctures of head coarse and widely separated, mostly obscured by pubescence. Prothorax cylindrical with a small linear callus at middle of disc; punctures confused, coarse, separated by their diameters or more. Scutellum triangular, moderately covered with greyish pubescence. Elytra fused along suture, costae evident, 1st and 5th intervals with two rows of punctures, 2nd and 4th with 1 row; apices asymmetrical, narrower than basal or medial elytral width. Meso- and metasterna heavily punctured, grey pubescent, 8th tergite protruding from the abdominal opening, rotundo-truncate at apex. Length: 6 to 9mm.

FEMALE: Similar to male but 8th tergite absent from abdominal opening and the general body form more robust. Length: 6 to 9mm.

TYPE: Holotype female, allotype male: U.S.A., FLORIDA: *Volusia County,* Lake Ashby, 5-VI, Hubbard & Schwarz (USNM). Paratypes: 4 specimens as follows: same data as type, 2 males, 1 female; FLORIDA: *Volusia Co.,* Enterprise, 1 male. One paratype in each of the following collections: USNM, AMNH, CISC, and the author.

This species, known only from Volusia County, Florida, has gone under the name of *suffusa* for many years (see discussion of *suffusa*). It is perhaps the most easily recognizable of the North American species due to the uniform, sparse pubescence (except for an occasional whitish spot or 2 on the elytral costae). Also, the drab, over-all grey-brown color will separate it from the other forms. It is my pleasure to name this taxon after Dr. J. A. Chemsak, University of California, Berkeley.

Spalacopsis (s. str.) stolata Newman
(Fig. 7,14,17)

Spalacopsis stolata Newman, 1842:304; LeConte, 1852:145; Melsheimer, 1853:110; Lacordaire, 1872:704; Schwarz, 1878:457; Horn, 1885:9; Henshaw, 1885:104; Leng & Hamilton, 1896:146; Casey, 1913:357; Craighead, 1923:134.

Spalacopsis pertenuis Casey, 1913:357; Mem. Coleop. 4:357; Casey, 1924:294; Mem. Coleop. 11:294; Breuning, 1962:44, Pesquisas 6(13):44. NEW SYNONYMY.

MALE: Integumental color reddish-brown to dark brown, underside darker; pubescence a mixture of ashy, white, and yellow-grey colors, region bordering elytral suture dark brown, lateral margins densely yellow-grey pubescent. Head usually as long as pronotum, covered with dense cinereous, white, and ashy-brown pubescence that usually obscures integument; scape longer than head, densely pubescent, mostly obscuring integument, segments 3 to 10 with many ventral fimbriations. Prothorax cylindrical, densely pubescent, integument mostly obscured, callus when present, small and ovoid; head and pronotum with dorso-lateral and a medial whitish lines. Scutellum triangular, densely pubescent with whitish hairs. Elytra mostly densely pubescent, sutural area and costal intervals with dark hairs and reduced pubescence; discal costae with variable whitish lines or spots, these usually slightly oblique; lateral margins with yellow-grey pubescence dense and with one or more whitish spots on the apical third. Underside densely pubescent. Length: 6 to 9mm.

FEMALE: Similar to male but body more robust. Length: 6 to 11mm.

TYPE: Holotype female, FLORIDA; Duval County, St. Johns Bluff, Doubleday & Foster (BM); of *pertenuis,* FLORIDA; Palm Beach, Casey Collection (USNM).

MATERIAL EXAMINED: FLORIDA: *Duval Co.*: Jacksonville, 3-III-1955, P. Wygodzinsky, 1 male. *Palm Beach Co.*: Delray Beach, 25-XII-1968, A. Moldenke, on *Verbesina,* 2 females; Delray Beach, 24-VI-1949, L. S. Light, on mango, 1 female; Lake Worth, 1 male, 1 female. *Martin Co.*: Jupiter, 24-IV, Hubbard & Schwarz, 1 male. *Dade Co.*: Biscayne, 23-V, Hubbard & Schwarz, 1 male, 1 female; Biscayne, 25-IV, Hubbard & Schwarz, 1 female. *Monroe Co.*: Key Largo, Wickham Collection, 1 female; Big Pine Key, 6-III, E. A. Schwarz, 1 female; Florida Keys, 1 female; Stock Island, 27-XII-1954, H. V. Weems, on *Flaveria linearis,* 1 male. *Putnam Co.*: Crescent City, Hubbard & Schwarz, 2 males. *Volusia Co.*: Enterprise, 14-II, D. M. Castle, 1 male; DeLeon Springs, 19-IV-1960, R. E. Woodruff, 1 male, 1 female; Lake Ashby, 1-VI, Hubbard & Schwarz, 1 female; Volusia Co., 24-II-1954, H. A. Denmark, 2 males. *Brevard Co.*: Indian River, 1 male. *Osceola Co.*: Kissimmee, 1 female. *Lake Co.*: Lake Co., 10-V-1956, H. V. Weems, 1 male. Additional material: FLA., Cazier Collection, 1 female; FLA., 1 male; Buena Vista, 28-VI-1918, M. Kisliuk, 1 female.

This species is very similar to *suffusa* but differs in the larger size, denser pubescence, more ornamented elytra, and distribution. *Spalacopsis stolata* is apparently restricted to the Atlantic Slope drainage system in Florida (Fig. 17). By the number of specimens examined it appears to be the most common species of the subgenus *Spalacopsis.* Casey's *pertenuis* is a small specimen of *stolata.* Breuning (1962:44) incorrectly synonymized *pertenuis* under *protensa* Pasco, a Mexican species.

Spalacopsis (s. str.) suffusa Newman
(Fig. 12,17,19)

Spalacopsis suffusa Newman, 1842:305; LeConte, 1852:145; Lacordaire, 1872:704 (in part); Schwarz, 1878:457 (in part); Horn, 1885:9 (in part); Breuning, 1962:45 (in part).
Spalacopsis suturalis Hamilton, *in* Leng & Hamilton, 1896:145; Casey, 1913:356. NEW SYNONYMY.
Spalacopsis exilis Casey, 1924:294. NEW SYNONYMY.

MALE: Integument brown to reddish-brown, first elytral interval appearing denuded, lateral margins densely pubescent becoming sparser dorsally. Antennal scape reaching to middle of pronotum, pubescence moderate, integument easily seen, segments 3 to 9 with a few (3 to 6) ventral hairs. Head as long as pronotum, covered with coarse pubescence that only partially obscures the integument and punctures. Prothorax cylindrical, pubescence moderate, integument always showing through, polished callus present, absent in 2 specimens, small, linear, generally ovoid; both head and pronotum with dorso-lateral and a medial whitish longitudinal lines. Scutellum triangular, covered with dense white pubescence. Elytra sparsely pubescent dorsally, sutural area with darker pubescence as to appear denuded, discal costae with variable areas of whitish pubescence; lateral margins usually densely covered with yellow-grey to grey pubescence. Legs with tarsal segments shining, sparsely pubescent. Length: 5 to 7mm.

FEMALE: Similar to male but with body usually more robust and elytra wider at middle. Length: 6 to 7mm.

TYPE: Holotype female, FLORIDA (no other data on specimen), (BM). Type locality as listed in the literature: St. Johns Bluff, Florida; of *suturalis*, Florida, Punta Gorda, Hubbard & Schwarz (3 cotypes, USNM); of *exilis*, Florida, Chokol (Chokoloskee, Collier Co.), W. S. Blatchley, Casey Collection (USNM).

MATERIAL EXAMINED: FLORIDA: *Charlotte Co.*: Punta Gorda, 9-IV-1952, O. Peck, 1 male. *Alachua Co.*: Newnan's Lake, 4-VII-1952, B. Theuer, 1 male; Alachua Co., 21-X-1956, R. A. Morse, 2 males. *Jefferson Co.*: Monticello, 4-8-X-1914, 1 female. *Collier Co.*: Naples, 28-III-1947, J. W. Green, 1 male. *Volusia Co.*: New Smyrna, 30-X-1927, E. D. Ball, 1 male. *Levy Co.*: Sea Horse Key, 11-V-1966, G. H. Wharton, 1 male. *Pinellas Co.*: Dunedin, 3-X-1927, W. S. Blatchley, 1 male. *Dade Co.*: Royal Palm Park, 24-III-1929, E. G. Linsley Collection, 1 male, 2 females; same data, 24-II-1926, 1 male.

Newman's type specimen was found to be a very worn, rubbed specimen of what had been considered to be *suturalis* Hamilton. Casey's *exilis* type is atypical in that it is sparsely pubescent but with very coarse hairs. From the material on hand *suffusa* is primarily found in the Gulf Coast drainage system of Florida (Fig. 17). Newman stated that the types of both his *stolata* and *suffusa* were from St. John's Bluff, eastern Florida. The type of *suffusa* has no other data than Florida and was probably collected along the St. John's River, the boundary of the Atlantic and Gulf Coast drainage systems in Florida.

Since its description, the name *suffusa* has been incorrectly applied to the new species here described as *chemsaki*. This is because Newman, in his original description, stated that the color was pale grey without shading, a fact that does not conform with his type specimen. Specimens from coastal western and southern Florida have the elytral pubescence longer and denser, giving them a strongly ornamented appearance. Specimens from inland and northern localities tend to have the pubescence shorter and sparser, thus vaguely ornamented (Fig. 19). The *suturalis* type is of the coastal form. *Spalacopsis suffusa* is closely related to *texana* Casey and, to a lesser degree, to *stolata*. They all appear to have evolved from the same parent species. Breuning (1962:43) incorrectly synonymized *suturalis* under *stolata*.

Spalacopsis (s. str.) texana Casey
(Fig. 15,18)

Spalacopsis texana Casey, 1891:146; Leng & Hamilton, 1896:146; Casey, 1913:356; Breuning, 1962:44.
Spalacopsis stolata, LeConte, *in* Schwarz 1878:470 (in part).

MALE: Integument dark brown to piceous, pubescence variable, usually dark with areas of white condensed as spots or lines on the elytral costae. Head about as long as pronotum, densely covered with grey and brown pubescence which partially covers the integument but most punctures show through; antennae as long as body, moderately fimbriated beginning with segment 3. Prothorax cylindrical with moderately dense pubescence which obscures most of integument, median polished callus small and linear; head and pronotum with vague dorso-lateral and a medial light pubescent lines. Scutellum triangular, densely clothed with white hairs. Elytra widest at apical third, apices separated and slightly asymmetrical; disc densely pubescent (on type specimen) less so in all other material examined, except for variable dark areas along the suture, these darker areas usually bordered apically by an oblique white line or spot which may join together. Underside uniformly, densely

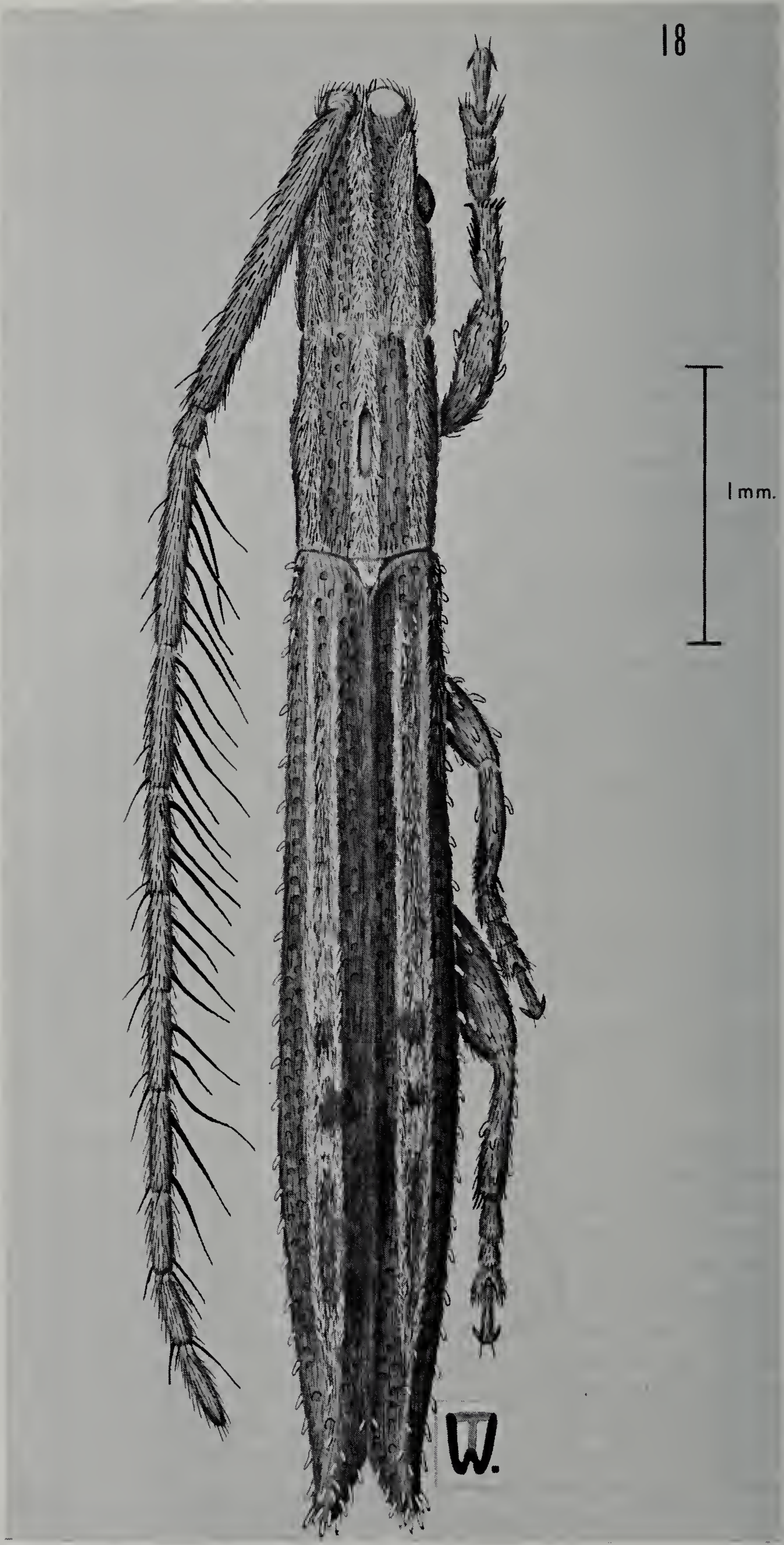

Fig. 18: *Spalacopsis (Spalacopsis) texana* Casey, male.

pubescent with apically converging white lines on sterna 2 to 4. Length, 5 to 6mm.

FEMALE: Similar to the male but slightly larger, more robust, and with pubescent ornamentation of elytra less distinct. Length, 5 to 9mm.

TYPE: Holotype female, TEXAS: Casey Collection (USNM).

MATERIAL EXAMINED: TEXAS: *Chambers Co.*: Anahuac, 10-X-1918, H. S. Barber, on *Hostelezkya,* 1 male. *Brooks Co.*: Falfurrias, III-1936, S. G. Kelley, on lantana, 1 male. *San Patricio Co.*: Welder Wildlife Refuge, nr. Sinton, 4-7-VIII-1963, A. T. Howden, 4 males, 4 females; same locality, 27-VIII-1970, C. W. O'Brien, 1 female. Additional Texas material: Mifflin, 26-VI-1952, H. E. Cott, 1 female; same locality, 6-VII-1952, H. E. Cott, 1 female; TEX. Cazier Collection, 1 female.

This species is allied to *suffusa* and to a lesser degree to *stolata.* It differs markedly from both in the very dark integument, the lack of dense yellow-grey pubescence on the lateral margins of the elytra, and in the distribution.

The locality label, on Casey's type specimen bears no other data than TEX. (without identifying marks). It may have been collected near the Rio Grande River in southwest Texas (determined from an unpublished list of Casey collection localities and corresponding identifying label marks, in the USNM). From the material on hand the range is apparently an inland strip along coastal Texas. The type specimen is the largest seen (9mm) and is very densely covered with fine pubescence. The smallest specimen seen for the genus was the male listed above from Falfurrias (4½mm).

Spalacopsis (s. str.) unicolor Tyson, NEW SPECIES

Spalacopsis filum, Wolcott, 1948, J. Agr. Univ. Puerto Rico 32(2):341 (in part?).

FEMALE: Head longer than prothorax, densely covered with long greyish pubescence, completely obscuring integument and punctures; antennae nearly as long as body, fimbriated beginning with segment 2, scape densely pubescent. Prothorax cylindrical, densely covered with long grey pubescence; head and pronotum with 3 faint longitudinal whitish lines, 1 medial the others dorso-lateral. Scutellum covered with whitish pubescence. Elytra fused along suture, slightly tapering apically, apex semicircular incised with outer margin nearly acuminate, surface densely clothed with long greyish pubescence, obscuring punctation. Underside densely clothed with grey pubescence. Length: 6½mm.

TYPE: Holotype female, PUERTO RICO: Aibonito, Diaz Fitica, 6-X-1933, R. G. Oakley (USNM). The only specimen seen.

Except for *chemsaki,* this is the only unicolorous species observed. It differs greatly from *chemsaki* in the very dense pubescence and the widely separated, incised apices of the elytra. Wolcott's record (1948:341) " . . . on the flowers of *Malpighia"* could possibly refer to this species. I have seen only 1 specimen of *filum* (Klug) from Puerto Rico, but the 2 species are easily separated.

ACKNOWLEDGEMENTS

I wish to thank the following individuals and institutions for the loan of specimens: E. C. Becker, Canadian National Collection of Insects, Ottawa (CNCI); H. F. Howden, Ottawa (through E. C. Becker); H. B. Leech, California Academy of Sciences, San Francisco; J. A. Chemsak, California Insect Survey, Berkeley (CISC); G. B. Vogt, United States National Museum, Washington, D.C. (USNM); L. Herman, American Museum of Natural History, New York (AMNH); T. H. Farr, Institute of Jamaica Science Museum, Kingston (IJSM); and R. E. Woodruff, Florida State Collection of Arthropods, Gainesville. My additional thanks to R. T. Thompson, British Museum of Natural History, London (BM) for the loan of Newman's types and to E. G. Linsley and J. A. Chemsak for the loan of photos of many types taken during the course of a National Science Foundation grant on the North American Cerambycidae. My special thanks to T. H. Farr for his valuable specimens and biological notes on *Spalacopsis filum filum* (Klug), and to L. M. Druckenbrod (USNM) who gave me valuable information on the preparation of the Figures.

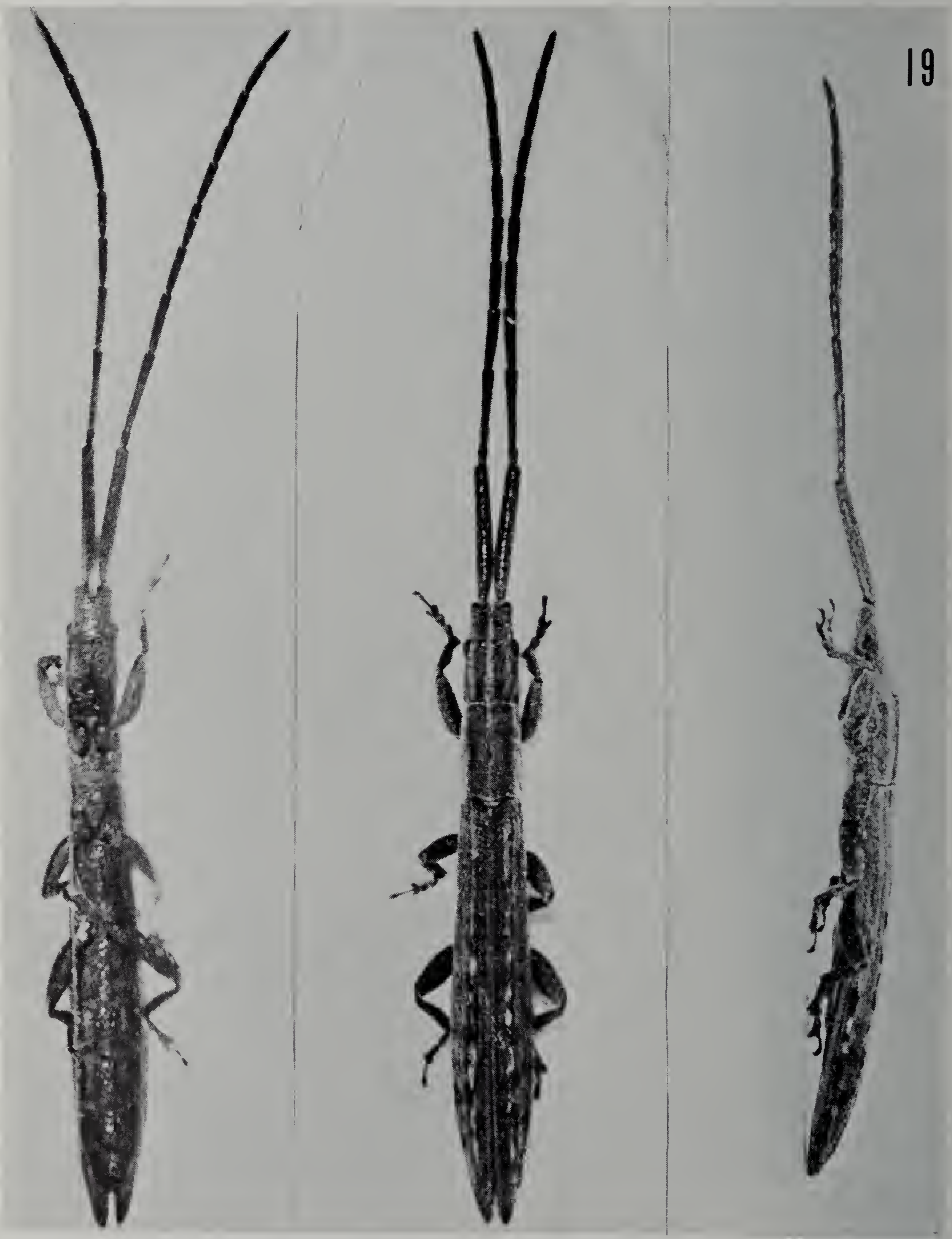

Fig. 19: *Spalacopsis (Spalacopsis) suffusa* Newman, male; ventral, dorsal, and lateral aspects. Photos by Robert Ing.

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Book Reviews

The following 3 books are all produced by the Reader's Digest Association, Inc., Pleasantville, New York 10570. They are superbly illustrated, and each offers some unique feature to the naturalist.

Fascinating World of Animals; a unique "safari" through our strange and surprising animal kingdom. 1971. By 32 major contributors. 428 p., with thousands of color photos and drawings; 10" × 12½"; $

This huge book is packed with an enormous variety of facts and illustrations, often of rare or unusual animals. It is divided into 3 parts: I) The 10 wildlife regions of the world (p. 12-319); II) The past, present, and future of animal life (p. 320-371); III) The animal kingdom (p. 372-421). The latter is exceptionally well done, with fine line drawings illustrating all the orders, each of which is shown on a single chart. Some entomologists might quarrel over according Class rank to Collembola, Diplura, Protura, and Thysanura, but they would want this beautiful book on their shelves.

Secrets of the Sea; marvels and mysteries of oceans and islands. 1972. 384 p., over 500 photos, paintings, diagrams, and maps; 9" × 11¼"; $

The title of this book would entice primarily marine biologists, and they would be justly rewarded. However, about half the book (p. 190-371) deals with islands and their respective faunas and floras. The general supervision was by Scientific Editor, Durward L. Allen, with 14 consultants, and Part I (The Living Sea) by W. J. Cromie, and Part II (Wonders of Island Life) by W. H. Amos. The superb color photos add the "topping" for this naturalists' dessert.

Scenic Wonders of America; an illustrated guide to our natural splendors. 1973. 575 p.; 400 full color photos; 8" × 11¼"; $

This latest volume is really outstanding in the extent of its coverage and the excellence of its photos of some of the world's unbelievable and awe-inspiring scenery. There are 50 easy-to-read maps and a 23 page campground directory. It has already been reviewed by many famous people, including Lowell Thomas, Billy Graham, Stewart Udall, etc. I cannot say it better than Norman Rockwell: " . . . really beautiful book and will be treasured by everyone who owns it."—R. E. Woodruff

* * *

Insect Fauna of St. Croix, United States Virgin Islands. 1970. George W. Miskimen and Richard M. Bond. 114 p. Issued as Vol. 13, Part I of the "Scientific Survey of Porto Rico and the Virgin Islands." Published by the New York Academy of Sciences, 2 E. 63 St., N. Y., N. Y. 10021. Price: $2.00.

Although published in 1970, this volume was just brought to my attention and deserves wider notice. It is primarily a checklist of the species recorded from St. Croix, with a short annotation for each. The 309 species of Coleoptera are treated on p. 78-101.—R. E. Woodruff

FOSSIL BEETLES FROM A FOSSIL WOOD RAT MIDDEN IN WESTERN TEXAS

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ABSTRACT

Fossil beetle remains have been found in a sample taken from a Late Quaternary wood rat midden. Three fragments have been assigned to the extant species, *Niptus abstrusus* Spilman (Coleoptera:Ptinidae).

THE SITE

The midden sample came from a cave located in Maravillas Canyon, in the Chihuahuan Desert of western Texas. It consisted of cemented plant debris, bones, and fecal pellets of a wood rat (*Neotoma* sp.). Based on radiocarbon dating, it was between 11,500 and 12,500 years old. The plant remains were described by Wells (1966) and included abundant fragments of pinyon pine (*Pinus cembroides*), juniper (*Juniperus pinchotii*), shrubby live-oak (*Quercus pungens*), and prickly pear (*Opuntia macrocentra*). The assemblage was interpreted by Wells as indicating the presence of a xerophilous woodland during the Late Quaternary, contrasting with the shrubby desert of the present day.

THE FAUNA

The midden sample (0.5 kg) was soaked in water to break down the cement, and the fragments were microscopically sorted. The insect fragments were structurally well-preserved, but their uniform yellowish-brown color indicated that they had undergone a pigment change.

IDENTIFIED TAXA: 2 right elytra, 1 left elytron: *Niptus abtruses* Spilman (Ptinidae); 1 pronotum: *Ptinus* sp. (Ptinidae); Base of a right elytron: gen. indet. (Scarabaeidae); 1 right elytron, 1 left elytron: possibly *Anthonomus* (Curculionidae).

The fossil elytra identified as *Niptus abtruses* were a perfect match with their modern counterparts and could be distinguished from the elytra of other members of the genus on the basis of punctation (Spilman 1968).

The species is a cave-dweller and Reddell (1966) reported individuals on raccoon droppings. It would therefore seem probable that the fossil individuals were associated with the wood rat fecal pellets. The present distribution of the species is in Western Texas (Fern Cave, Val Verde County; Bat Cave, Marischal Mountains, Brewster County) and Coahuila, Mexico (Pedrigosa Circle Cave; Pedrigosa Pipe Cave; Cueva de San Vincente). The fossil occurrence is within the present distributional area.

Insect remains are common fossils of Quaternary peat and silt deposits in the northern states (Ashworth & Brophy 1972; Ashworth, Clayton, and Bickley 1972, but I do not know of similar deposits in the arid Southwest.

Therefore, wood rat middens, although a specialized environment, may provide an opportunity of studying at least a part of the Quaternary insect assemblage of that region.

ACKNOWLEDGMENTS

I wish to thank Dr. T. J. Spilman for examining the specimen of *Niptus* and for supplying habitat and distributional information.

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COLEOPTERISTS SOCIETY MEETING

The annual meeting of the **Coleopterists Society** will be held in conjunction with that of the **Entomological Society of America** at Dallas, Texas. Our meeting will be on Wednesday, Nov. 28, 1973, in the Gold Room of the Statler Hilton Hotel. The exact time has not been established, but it will be posted at the meeting. We hope that all Coleopterists who plan to attend the ESA meetings will make plans to get together on Wednesday evening.

Plans for the field trip to Welder Wildlife Area have not yet been made final, but details will be announced at the meeting. Further information can be obtained by writing to the Coleopterists Society President, Dr. George E. Ball, Dept. Ent., Univ. of Alberta, Edmonton, Alberta, Canada.

ASSOCIATION OF *PITYOPHTHORUS OPIMUS* WITH *PISSODES TERMINALIS* IN COLORADO LODGEPOLE PINE (COLEOPTERA:SCOLYTIDAE & CURCULIONIDAE)

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Abstract

Pityophthorus opimus Blackman is reported as an associate of *Pissodes terminalis* Hopping in Colorado *Pinus contorta* Dougl. These observations constitute new host and locality records for *P. opimus* and also indicate an example of commensalism between the 2 beetle species.

Pityophthorus opimus Blackman is widely distributed throughout the western United States, but little is known of its life history and ecological relationships. Blackman (1928) initially reported it from *Picea engelmannii* Parry from the Capitan Mountains, New Mexico, from several Colorado localities, and also from *Pinus flexilis* James in Colorado. Bright (1964) described it as *P. aristatae* from *Pinus aristata* Engelm. in the White Mountains, Mono County, California, but subsequently (1971) concluded his specimens in fact represented *P. opimus.*

I commonly find *P. opimus* in terminals of lodgepole pine, *Pinus contorta* Dougl., that have been attacked by the lodgepole terminal weevil, *Pissodes terminalis* Hopping, along the Front Range of the Rocky Mountains in northern Colorado. It appears to have a 1-year life cycle, with emergence and oviposition occurring in midsummer. By this time *Pissodes* have fed, oviposited, and emerged (my unpublished data), and the attacked terminals have begun to dry out. This presumably provides a suitable environment for development of *P. opimus.* Successful infestation of the terminal by *Pissodes* is not required for success of *P. opimus*; broods of the latter are sometimes found in leaders killed by *Pissodes,* but in which no weevils develop. In my observations *P. opimus,* like its associate, infests only terminals. I have not found it in laterals.

The relationships of these 2 species to each other provides an example of commensalism. The *Pissodes* in effect prepare the site for the *Pityophthorus. Pissodes* larvae occupy portions of the phloem area for only a short while, then they move to the pith. The *Pityophthorus* eggs hatch about the time the weevils migrate to the pith, and the remaining phloem area (usually a more than adequate amount) is left for the use of the scolytids.

Three species of parasitic Hymenoptera were collected from *P. opimus* galleries. These include *Eurytoma tomici* Ashmead (Eurytomidae) and *Rhopalicus pulchripennis* (Crawford) and *Acerocephala atroviolacea* (Crawford) (Pteromalidae). All these species are known parasitoids of conifer-infesting Coleoptera (Muesebeck and Krombein 1951).

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[1] Central headquarters maintained in cooperation with Colorado State University at Fort Collins.

ACKNOWLEDGMENTS

I thank the following specialists for their identifications: D. E. Bright, *Pityophthorus opimus*; C. W. O'Brien, *Pissodes terminalis*; and B. D. Burks, *Eurytoma, Rhopalicus,* and *Acerocephala.*

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BOOK NOTICES

A revision of the genus *Sennius* of North and Central America (Coleoptera: Bruchidae) by Clarence D. Johnson and John M. Kingsolver. 1973. U. S. Dept. Agr. Tech. Bull. 1462:1-135; 141 Fig. (For sale by Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. $1.75).

Systematics of the genus *Coelocnemis* (Coleoptera: Tenebrionidae); a quantitative study of variation by John T. Doyen. 1973. Univ. California Publ. in Ent. 73:1-120, 74 Fig. (For sale by Univ. California Press, 2223 Fulton St., Berkeley, CA 94720; $3.50).

A revision of the genus *Tachinus* (Coleoptera: Staphylinidae) of North and Central America by J. M. Campbell. 1973. Mem. Ent. Soc. Canada 90:1-137; 189 Fig.

A revision of the genus *Petalium* LeConte in the United States, Greater Antilles, and the Bahamas (Coleoptera: Anobiidae) by E. J. Ford, Jr. 1973. U. S. Dept. Agr. Tech. Bull. 1467:1-40; 36 Fig. (For sale by Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. $.45).

The leaf beetles of Alabama (Coleoptera: Chrysomelidae) by Edward U. Balsbaugh, Jr. & Kirby L. Hays. 1972. Auburn Univ. Exp. Sta. Bull. 441:1-223; 43 Fig.

The scarab beetles of Florida (Coleoptera: Scarabaeidae), Part I. The Laparosticti (Subfamilies: Scarabaeinae, Aphodiinae, Hybosorinae, Ochodaeinae, Geotrupinae, and Acanthocerinae) by Robert E. Woodruff. 1973. Arthropods of Florida and Neighboring Land Areas 8:1-220; 407 Fig. (For sale by Florida Dept. Agr., Div. Plant Industry, P. O. Box 1269, Gainesville, FL 32601. $3.00)

Klucze do Oznaczania Owadów Polski [Insects of Poland, Part XIX, 98d Curculionidae, subfamily Curculioninae] by Stanislaw Smreczynski. 1972. 195 p.; 373 Fig. [In Polish] (Available in exchange from Polskie Prismo Ent., UL Cybulskiego 30, Wroclaw, Poland).

THE TRUE LARVA OF *HEXACYLLOEPUS,* WITH A DESCRIPTION OF THE LARVA OF *H. FERRUGINEUS* AND A SUMMARY OF RECORDS FOR THE GENUS.

(COLEOPTERA: ELMIDAE)

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Abstract

The larva described in 1959 by Sanderson and Brown as that of *Hexacylloepus* was in reality that of *Microcylloepus* sp. The true larva of *Hexacylloepus* has now been found in 18 localities in Oklahoma, Texas, New Mexico, Mexico, Grenada, Trinidad, Venezuela, Brazil, Paraguay, and Bolivia. It is described and figured. This larva is perhaps closest to that of *Stenelmis* in fundamental characters, but differs in a number of ways. Its most distinctive feature is the unusually long ninth abdominal segment, which superficially resembles that of larval *Dubiraphia.* Methods are suggested for insertion in existing keys by Bertrand, Hinton, Leech and Chandler, and Leech and Sanderson. Records of 5,268 *Hexacylloepus* adults and 57 larvae from 177 localities in 16 countries are recorded. The genus has not previously been recorded from the state of New Mexico in the U. S., nor from Bolivia, British Honduras, Colombia, Costa Rica, El Salvador, Honduras, Nicaragua, or Paraguay.

Introduction

In the spring of 1953, Milton Sanderson was working on a revision of the elmid beetles of the United States. He was anxious to include a description of the larva of each genus, and he had succeeded in associating larval types with every genus then known in the United States except *Hexacylloepus.* As I was located within range of a possible collecting site, he enlisted my assistance. One specimen of *Hexacylloepus* had been found in Pennington Creek at Reagan, Oklahoma in 1937. I agreed to look for the larva, knowing only that it would probably be a tiny, worm-like creature a few millimeters in length, perhaps clinging to submerged stones.

In the summer of 1953 I undertook the search, and collected everything I could find that looked remotely promising. At the time I was teaching Field Entomology at the University of Oklahoma Biological Station, and the entire class joined the quest on a field trip. Upon receiving and examining our collection, Sanderson informed me that it included a specimen of what must be the larva of *Hexacylloepus,* and hoped that I might obtain more specimens. By October, I had sent him over a dozen, along with *Hexacylloepus* adults, numerous larvae and adults of *Microcylloepus,* and assorted other dryopoid beetles. These provided the basis for inclusion of *Hexacylloepus* in the larval key in the revised edition of Ward and Whipple's "Fresh-water Biology" (Leech and Sanderson, 1959). In a joint paper listing known Oklahoma dryopoids, Sanderson described the larva of *Hexacylloepus* and I discussed the ecology of the beetles covered (Sanderson and Brown, 1959). On this information, Bertrand (1965) amended his key to larvae of New World dryopoids, and has presumably incorporated this treatment of *Hexacylloepus* in his key to larval dryopoids of the world, which is now in press.

Meanwhile, I have become increasingly interested in dryopoids and have devoted most of my attention to them in the past 10 years. This has involved extensive collecting throughout much of the western hemisphere, and I have collected *Hexacylloepus* from Oklahoma to Brazil, often in considerable numbers. But I experienced repeated frustration in my attempts to distinguish the larvae of *Hexacylloepus* from those of *Microcylloepus,* which almost invariably share the same habitat. For a while, I sorted them out with some degree of confidence—at least those from the United States—, but this was abandoned when a few living larvae identified as *Hexacylloepus* pupated and emerged as adults of *Microcylloepus.* In other words, the larvae we happily assumed to be those of *Hexacylloepus* simply were not. For some years I have been on the lookout for the actual larva of *Hexacylloepus.* In the summer of 1971 I found a good prospect. During the autumn, on a rather extensive collecting trip in Central and South America, I obtained good corroboration. Then, upon re-checking other material, including unidentified larvae, I found that I already had a few on hand, some dating back as much as 10 years. To make it all the more embarrassing, some of these specimens were from Pennington Creek—carelessly misidentified not as larvae of *Microcylloepus,* but as those of *Dubiraphia.* The larva, though in many fundamental characters quite similar to that of *Microcylloepus,* bears a superficial resemblance to the rather bizarre, long-tailed larva of *Dubiraphia.*

I now have a total of 57 specimens of this larval type from 18 localities: 2 localities in Oklahoma, 1 in New Mexico, 3 in Texas, 2 in Mexico, 1 in Grenada, 1 in Trinidad, 2 in Venezuela, 4 in Brazil, 1 in Paraguay, and 1 in Bolivia. In all but 2 cases, the larvae were associated with adults of *Hexacylloepus,* and in these 2 cases adults were taken in nearby streams. Furthermore, there were present no other genera for which the larvae were unknown. The circumstantial evidence is thus quite convincing, although I have not reared larvae of this type and obtained adult *Hexacylloepus.*

Generic characters of the larva of *Hexacylloepus* Hinton

Body parallel, hemicylindrical (Fig. 1). Head when viewed dorsally exposed and not concealed by pronotum; anterior margin on each side between antenna and clypeus with an inconspicuous tooth (Fig. 2). Eye on each side consisting of a cluster of about 5 ocelli fused into a single compact unit. Antenna feebly retractile, 3-segmented; second segment longest; third segment shorter than first, slender and setiform, bearing a minute apical seta; alongside third segment and subequal to it in diameter but slightly longer is a blunt-tipped seta arising from apex of second segment. Maxilla with the palp 4-segmented; stipes not well differentiated into a palpifer; galea and lacinia separate, each bearing an apical cluster or tuft of heavy spines (Fig. 4). Labium (Fig. 5) subquadrate; palp 3-segmented; anterior angle of mentum with a relatively large mental palp or seta.

Posterior margins of both tergites and sternites and anterior margin of prothorax bordered by dentate tubercles bearing long, membranous setal tufts (Fig. 8-10).

Ninth abdominal segment conspicuously elongate, at least 3 times longer than wide, with a feeble longitudinal mid-dorsal carina, and with an arcuate apex (Fig. 1, 9). In some species there is also on each side a weak sublateral carina, giving this segment a pentagonal shape in cross-section. Ventrolateral margins bordered by a dense row of short, stiff spines of rather uniform length.

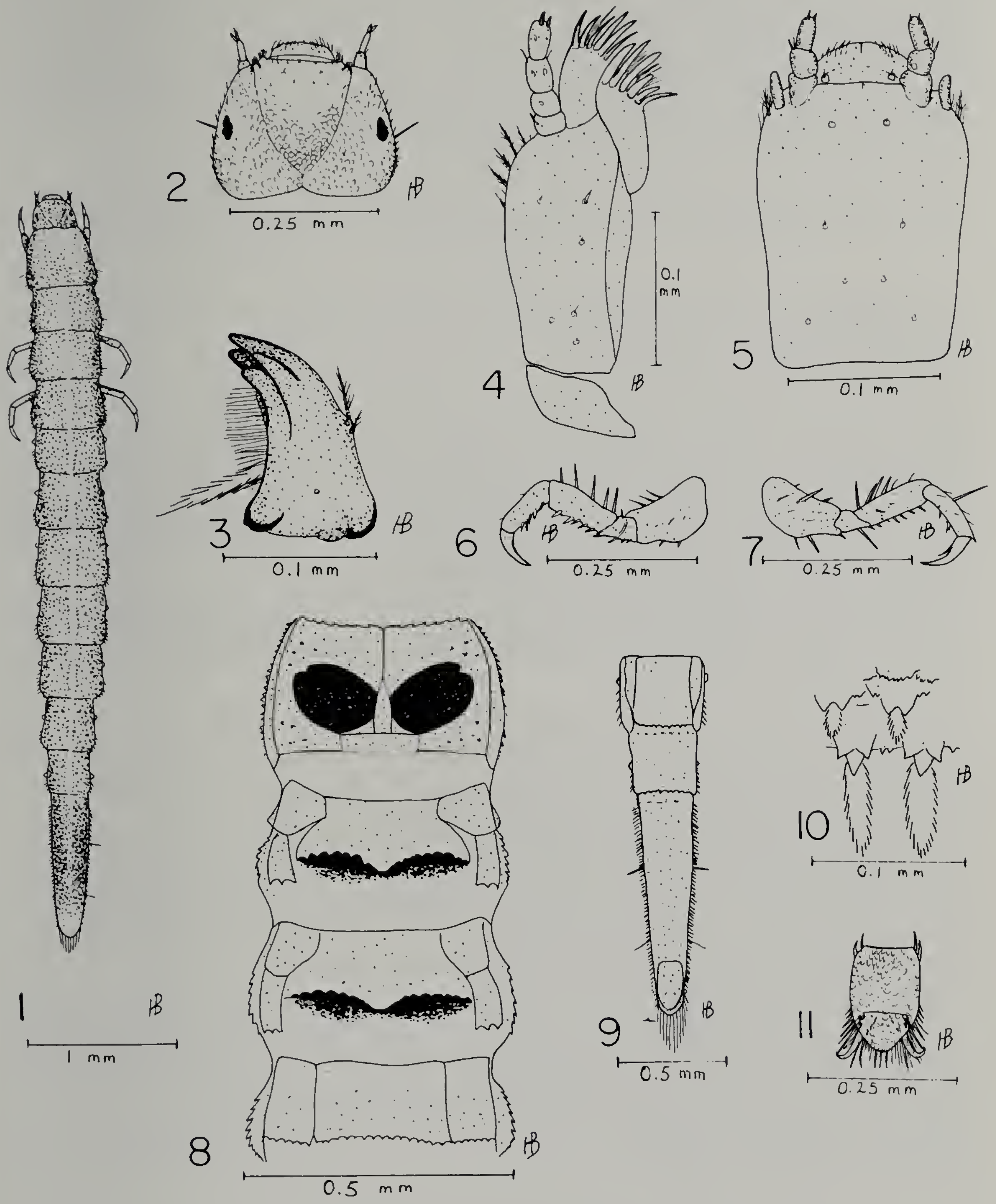

Fig. 1-11. *Hexacylloepus ferrugineus* larva: 1) dorsal aspect, entire; 2) dorsal aspect of head; 3) mandible; 4) maxilla; 5) labium; 6) front leg; 7) middle leg; 8) sclerites of thorax and first abdominal segment, ventral aspect; 9) abdominal segments 7-9, ventral aspect; 10 tubercles and tufted setae of second abdominal sternite near middle of posterior margin; 11) operculum of ninth abdominal segment, ventral aspect.

Operculum less than one-third as long as ninth segment (Fig. 9, 11), bearing a pair of long, recurved hooks attached to its dorsal surface and bordered posteriorly with rather long setae. With 3 tufts of long, filamentous, retractile anal gills.

Procoxal cavities closed and separated medially by a relatively prominent sclerite (Fig. 8). Prothoracic pleura undivided, those of the 2 sides meeting in the midventral line anterior to the coxae; posterior sternum broader than long. Meso- and metapleura each divided into 2 parts (Fig. 8). Abdominal segments 1-7 with pleura bounded by tergo- and sternopleural sutures; these sutures converge and meet on seventh segment (Fig. 9). Tuberculate spiracles present on mesothorax and first 8 abdominal segments.

Description of larva of *Hexacylloepus ferrugineus* (Horn)

(Fig. 1-11)

In addition to the characters listed above, the larva of *H. ferrugineus* exhibits the following features:

Light grayish brown, darker on head and anterior part of pronotum; darkest on ninth abdominal segment, which is blackish brown except for testaceous apex. Sides of head pale around and behind eyes. Body with lighter patches on posterior portion of pronotum and on sides of mesonotum, metanotum, and first 6 abdominal tergites. These light areas feebly accented by small, diffuse, darker spots. Legs and antennae testaceous. Mouthparts testaceous to rufo-testaceous, the mandibles darkest.

Mid-dorsal line lighter in color, extending from pronotum to eighth abdominal segment, and bordered on each side by an irregular row of small, flat tubercles; light-colored area widest near middle of each segment except pronotum (Fig. 1).

Dorsum of head covered with flattened scales; lateral margin with anteriorly-directed setae, especially around eye (Fig. 2). Cuticle of body largely covered with flattened scales, rather sparsely intermingled with larger flattened tubercles, especially on the dorsal surface.

One mandible (Fig. 3) with 4 apical teeth, the shorter 2 rather blunt, the other 2 subacute; prostheca long and densely spinose; medial margin bordered with a rather dense brush of erect hairs or spines; lateral margin bearing 1 or 2 prominent, apically-directed plumose setae. The other mandible with 3 subacute apical teeth and a rudimentary fourth tooth.

Clypeus with a small tooth or projection on each angle bearing 1 or more tufted membranous setae. Fronto-clypeal suture visible in cleared specimens at high magnification. Labrum broadly arcuate, with an irregular basal row of brush-like membranous setae and sparse, small marginal setae.

Legs relatively slender and elongate (Fig. 6, 7); claws long, slender, with a small seta on inner margin.

COMPARATIVE NOTES

The adults of *Hexacylloepus* are probably closer to the genus *Cylloepus* than to any other genus in North or Central America, at least on the basis of external morphology (Hinton, 1940). *Hexacylloepus* adults are not very similar, either externally or internally, to *Elsianus, Microcylloepus,* or *Stenelmis.* The larva of *Hexacylloepus,* on the other hand, is strikingly different from that of *Cylloepus,* more closely resembling that of *Elsianus, Microcylloepus, Neocylloepus,* or *Neoelmis* (Hinton, 1940; Brown, 1970; Sanderson, 1953-54). For example, it resembles each of these and differs from the larva of *Cylloepus* in exhibiting a posterior prothoracic sternum, in having meso- and metapleura divided into 2 parts, and in having abdominal pleura on only the first 7 segments; furthermore, the abdominal pleura are bounded by tergo- and sternopleural sutures which converge on the seventh segment. The body is also hemicylindrical rather than cylindrical in shape. However, the prothoracic pleura are undivided, as in *Cylloepus.* Other differences between the larva of *Hexacylloepus* and the larvae of any of these other genera are: (1) the unusually long ninth abdominal segment—3 to 4 times longer than wide—with its proportionately smaller operculum, which is only about half as wide and one-third to one-fourth as long as the ninth segment; (2) labial palp 3-segmented rather than 2-segmented; (3) one mandible with 4 apical teeth rather than 3 (difficult to observe); (4) the sclerite separating the procoxal cavities is unlike that of any of these genera.

In exhibiting a posterior sternum, meso- and metapleura of 2 parts, and pleura on the first 7 abdominal segments, the larva fulfills the predictions of Sanderson (1953-54) as to what the larva of *Hexacylloepus* would probably be like.

Perhaps the larva of *Hexacylloepus* is closest to that of *Stenelmis,* described as "larval type 5" by West (1929). It resembles the *Stenelmis* larva in having 3-segmented labial palps and undivided prothoracic pleura, as well as in the general nature of the sternites and pleurites, but differs in having an inconspicuous frontal tooth, a mandible with 4 apical teeth, a mid-dorsal line with associated tubercles, and the ninth abdominal segment conspicuously elongate with an arcuate apex and no apical spines or teeth.

ECOLOGY

Hexacylloepus appears to be characteristic of streams high in dissolved calcium content, especially those containing and forming travertine. Among the usual genera associated with it in such streams are the limnichid *Lutrochus* and the elmids *Microcylloepus* and *Neoelmis.* Less constantly associated with it are *Elsianus* and *Neocylloepus.* Adults are relatively conspicuous and often present in considerable numbers. In good habitats, I commonly collect only about 10% of the adults of *Hexacylloepus* and *Microcylloepus* taken in the net or observed upon stones removed from the stream. Larvae of *Microcylloepus* are abundantly present in association with the adults. This is not the case with *Hexacylloepus,* but I have not been able to determine just what the microhabitat is (hence the paucity of larvae, despite my careful search for them). The larvae I have knowingly collected were taken mostly from the undersides of travertine-covered rocks and pebbles, some in fast water only a few centimeters deep, others at a depth of almost a meter, in relatively slowly moving water just below a riffle. In the latter situation, they were accompanied by larvae and adults of *Dubiraphia,* and in all situations there were at least a few *Microcylloepus* adults and larvae. Nearby on submerged wood where *Microcylloepus* larvae were abundant I found no *Hexacylloepus* larvae, though adults were present. My reasoning that the unusually long ninth abdominal segment might be correlated with a more elaborate set of anal gills, enabling the larva to subsist in slower and perhaps less oxygen-rich water appeared to be borne out rather well for *Dubiraphia* larvae, but seemed much less productive with respect to *Hexacylloepus*. As yet I have not discovered prepupal larvae or pupae, but it is likely that they occur in the crevices of moist travertine not far above the water level, or beneath somewhat loose bark or stones near the water.

Summary of records for the Genus *Hexacylloepus*

Published records of this genus, especially in the United States, are few and scant. In his description of *Hexacylloepus ferrugineus,* Horn (1870) indicated only that it had been collected by Belfrage in Texas. Brown (1956) listed this species from Johnston Co., Oklahoma, and Sanderson and Brown (1959) cited records of it from Murray Co. as well as from Johnston Co., Okla. Brown and Shoemake (1964) added Bryan, Coal, and Pontotoc to the list of Oklahoma counties. Burke (1963) stated that *H. ferrugineus* was common in streams throughout the Balconian biotic province of Texas, but gave no further detail.

Table 1. Records of *Hexacylloepus ferrugineus* in the U.S. (numbers indicate localities, adults, and larvae respectively) [Total: 48, 3133, 18]:

New Mexico: Eddy Co. (2, 20, 1).
Oklahoma: Bryan Co. (2, 19, 0); Coal Co. (1, 3, 0); Johnston Co. (8, 1379, 14); Murray Co. (4, 44, 0); Pontotoc Co. (1, 3, 0)
Texas: Bandera Co. (1, 2, 0); Blanco Co. (2, 12, 0); Coryell Co. (1, 82, 0); Edwards Co. (2, 94, 0); Hays Co. (3, 89, 1); Johnson Co. (1, 5, 0); Kerr Co. (2, 84, 0); Kinney Co. (1, 114, 1); Llano Co. (1, 4, 0); McCulloch Co. (1, 7, 0); Medina Co. (1, 12, 0); Menard Co. (3, 141, 0); Real Co. (3, 111, 0); Runnels Co. (1, 1, 0); Travis Co. (1, 5, 0); Uvalde Co. (2, 117, 0); Val Verde Co. (3, 558, 1); Zavala Co. (2, 92, 0).

Table 2. Records of Neotropical *Hexacylloepus* spp. (numbers indicate localities, adults, and larvae respectively) [Total: 129, 2135, 39]:

Bolivia: Dept. Santa Cruz (4, 16, 1).
Brazil: Dist. Fed. (5, 178, 0); State of Goiás (3, 16, 0); State of Maranhão (3, 10, 2); State of Pará (4, 90, 3); State of Parana (5, 23, 1).
British Honduras: (4, 13, 0).
Colombia: Cundin-Amarca (1, 3, 0).
Costa Rica: (6, 67, 0).
El Salvador: (1, 4, 0).
Grenada: (3, 14, 1).
Guatemala: (9, 40, 0).
Honduras: (2, 5, 0).
Mexico (States): Chiapas (7, 24, 0); Coahuila (13, 809, 1); Colima (6, 69, 0); Guerrero (6, 32, 0); Jalisco (5, 196, 0); Morelos (3, 7, 0); Nayarit (1, 8, 0); Nuevo Leon (1, 1, 0); Oaxaca (1, 7, 0); Puebla (3, 27, 0); San Luis Potosi (7, 149, 0); Tamaulipas (2, 8, 0); Vera Cruz 2, 6, 0); Zacatecas (1, 30, 1).
Nicaragua: (3, 12, 0).
Panama: (7, 15, 0).
Paraguay: (2, 5, 11).
Trinidad: (2, 99, 15).
Venezuela (States): Carabobo (1, 19, 2); Cojedes (2, 88, 1); Guarico (2, 28, 0); Portuguesa (1, 6, 0); Yaracuy (1, 11, 0).

Hinton (1940) created the genus *Hexacylloepus* to include Horn's *Elmis ferrugineus*, 2 new Mexican species, and 12 species previously included in the genus *Cylloepus* which range from central Mexico to southern Brazil. The genus is also represented on the islands of Grenada and Trinidad (Hinton, 1971). A total of 22 species are now known, but in most cases the only distributional record available is that indicated in the original description, which was based upon a few specimens from 1 or 2 localities.

In view of the paucity of records for the genus, it seems worthwhile for me to list at least a summary of my specimens, even though I have not yet had the opportunity to work with them at the specific level. As indicated in Tables 1 and 2, these records represent a total of 3,133 adult and 18 larval specimens from 48 localities in the United States and 2,135 adult and 39 larval specimens from 129 Neotropical localities. These specimens await further study in the Dryopoid Collection of the Stovall Museum of Science and History at the University of Oklahoma.

Modification of existing keys to include *Hexacylloepus*

Since Bertrand's (1965) modification of his key to include the larva of *Hexacylloepus* actually related to a species of *Microcylloepus*, the following change is proposed for his 1955 key. On page 135, delete from number 24 the parenthetical "*Stenelmis* auct." and insert a couplet as follows:

24a. Neuvième segment abdominal très allongé, sans dents postérieures .... *Hexacylloepus* Hinton

24b. Neuvième segment abdominal non très allongé, avec dents postérieures bien écartées .... (*Stenelmis* auct.)

In the key given by Hinton (1940:230), change the lead number of the second choice for couplet 5 from 10 to 5a and add the following couplet:

5a. Ninth abdominal segment more than 3 times longer than wide .... NORTH and SOUTH AMERICA .... *Hexacylloepus* Hinton 1940

Ninth abdominal segment less than 3 times longer than wide 10

In the key given by Leech and Chandler (1963:360), change the lead number of the second choice for couplet 21 from 22 to 21a and add this couplet:

21a. Ninth abdominal segment more than 3 times longer than wide; prothoracic pleura undivided; labial palp 3-segmented .... *Hexacylloepus* Hinton 1940

Ninth abdominal segment less than 3 times longer than wide; each prothoracic pleuron divided by a suture extending laterally from procoxal cavity to margin; labial palp 2-segmented 22

In the key given by Leech and Sanderson (1959:1017-1018), modify couplets 69b and 70 to read as follows:

69b. Abdominal segments with flat tubercles which may or may not be arranged in rows 70
70a. (69) Last abdominal tergite (Fig. 38.85) slightly emarginate or straight at apex, and less than 3 times longer than wide; posterior margin of each tergite often with a pale spot at middle .... *Microcylloepus* Hinton
70b. Last abdominal tergite arcuate at apex and more than 3 times longer than wide; each tergite with pale median line broadest near middle rather than at posterior margin .... *Hexacylloepus* Hinton

ACKNOWLEDGEMENTS

All of the figures were traced from Polaroid photographs, the film for which was provided by a grant from the University of Oklahoma Faculty Research Committee. I also express my thanks to Mrs. Ginna Davidson, staff artist of the Department of Zoology, who inked the drawings.

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No. 10

THE
COLEOPTERISTS
NEWSLETTER

SEPT. 1973

EDITOR: CHARLES W. O'BRIEN, UNIV. P. O. BOX 111
FLORIDA A AND M UNIVERSITY, TALLAHASSEE, FL 32307

Lois and I were unable to get our vehicle in time for the Central American trip this summer so we've postponed it for one year.

We have determined through talks with Bob Woodruff that we must have the **Newsletters** ready for the printer one month before the **Bulletin** goes to press (i.e., February 1, May 1, August 1, and November 1). We would therefore appreciate receiving materials not later than 2 weeks prior to these dates, or we may not be able to include the information.

Response concerning the new format has been favorable thus far. We'd like to hear from more members so we can report on it at the Dallas meetings. Please let us hear from you, pro or con. Thanks.

HORN AND DIETZ COLLECTIONS MOVE TO HARVARD

In the near future, the major portion of the George H. Horn and William G. Dietz Collections will be moving to the Museum of Comparative Zoology, Harvard University. About 25,000 specimens, representing species described by Horn, LeConte, and Dietz, and presently housed at the Academy of Natural Sciences of Philadelphia, will be exchanged for the Scudder and Morse Collections of orthopteroid insects now at Harvard. Horn and LeConte together described about 6,000 North American beetles, and since they exchanged material, their cotypes are often found in both collections. When these two collections are combined at the M.C.Z., it will be possible for taxonomists to examine the entire series at one Museum and to select appropriate lectotypes when necessary. The actual exchange of this material will begin this year, but it may take some time. Further time will be required to properly house the Horn specimens and ultimately to integrate the LeConte and Horn series in order to facilitate their study. It is suggested that requests for loans of Horn material be postponed until late 1974 or early 1975, unless absolutely necessary.—John F. Lawrence, M.C.Z.

SOCIEDAD CHILENA DE ENTOMOLOGIA

Recently Volume 7 of **Revista Chilena de Entomologia** has been published and is for sale for $7.50, U. S. Those interested in buying this volume should send this plus $2.00 for air mail postage or $0.50 for surface. The Society is interested in publishing Volume 8 soon, for which it is accepting all works relating to Neotropical insects. Anyone interested may write to the Society, (Casilla 2974, Santiago, Chile), for details. This will be the volume commemorating the 50th anniversary of the Society which was celebrated 18-23 June 1973.—L. E. Peña G.

LARVAE OF COLEOPTERA

The Coleoptera volume for the revision of Peterson's "Larvae of Insects" is now being planned under the editorship of John F. Lawrence, Museum of Comparative Zoology, Harvard University. In this volume each section covering a family or group of families will be separately authored. A section will consist of a family diagnosis, occasionally keys to subfamilies, a general coverage of habits, habitat, etc., and brief descriptions and illustrations of from one to several family representatives. As in the original edition, there will be an emphasis on economically important groups, but in the revision there will be an attempt to include phylogenetically important groups as well, even when these are rare or exotic. The family key will include all beetle families for which larvae are known, but an alternate key is planned which will be restricted to the more commonly encountered North American groups.

The contributors to this volume and their group assignments are as follows: D. M. Anderson (Bruchidae, Curculionoidea, except Scolytidae and Platypodidae), J. R. Barron (Trogositidae), R. S. Beal (Dermestidae), E. C. Becker (Elateroidea), C. Besuchet (Pselaphidae), H. P. Brown (Psephenidae, Limnichidae, Dryopidae, and Elmidae), J. M. Campbell (Alleculidae), R. A. Crowson (Clambidae), J. T. Doyen (Tenebrionidae), H. S. Dybas (Ptiliidae, Limulodidae), G. Ekis (Cleridae), D. E. Foster (Melyridae), J. H. Frank (Staphylinidae and Scaphidiidae), L. M. Gardiner (Cerambycidae), H. Goulet (Carabidae and Cicindelidae), T. F. Hlavac (Ptilodactylidae), D. Kavanaugh (Amphizoidae), G. G. Kennen (Eucinetidae), F. A. Lawson (Chrysomelidae), J. E. Lloyd (Lampyridae), A. Newton (Scydmaenidae), S. B. Peck (Leiodidae, Silphidae, and Leptinidae), P. Perkins (Hydraenidae), P. O. Ritcher (Scarabaeoidea), R. B. Selander (Meloidae), P. J. Spangler (Dytiscidae, Noteridae, Haliplidae, Gyrinidae, Hydrophilidae, and Chelonariidae), T. J. Spilman (Pythidae, Salpingidae, and Tenebrionidae), M. G. de Viedma (Melandryidae and Anobiidae), S. L. Wood (Scolytidae and Platypodidae), and D. K. Young (Othniidae and Pyrochroidae).

Many of the remaining smaller families will be treated by the editor, but volunteers would be appreciated for the following groups: Histeridae, Buprestidae, Phengodidae, Lycidae, Cantharidae, Ptinidae, Lyctidae, Nitidulidae, Erotylidae, Coccinellidae, Endomychidae, Mordellidae, and Rhipiphoridae. If anyone is interested in contributing to this volume, or if further information is needed, please contact me. Suggestions on format, etc. would also be welcome.—John F. Lawrence, M.C.Z.

SOCIETY ARCHIVES

The archives of the Coleopterists Society have been deposited in the Smithsonian Archives Office after having been received from past-president Ross Arnett. Further material may be sent for such deposition.—Paul J. Spangler, National Museum of Natural History, Washington, D. C. 20560.

LECTURES ON BEETLE EVOLUTION

At the annual meeting of the Coleopterists' Society, to be held in Dallas in conjunction with the Ent. Soc. Amer. meetings (Nov. 26-29, 1973), we will depart from the usual procedure, in that the business meeting will be followed by 2 short, formal presentations on the evolution of beetles. John Lawrence will speak on "Major Lineages in the Evolution of the Coleoptera", and Tom Hlavac will speak on "The Adaptive History of Beetles: Questions, Speculations". It is hoped that similar programs may be offered at future meetings.—John F. Lawrence, M.C.Z.

NIGHT COLLECTING WITH HEADLAMP AND SHEET

In 1964, after I had been collecting in California for weevils for nearly 5 years with rather poor results, Dr. Elbert Sleeper told me to sweep and beat at night. Night collecting opened up a new world, and a very large part of my later successes in the field have been due to this practice.

My wife and I started as a team, with a Coleman lantern, a net and a beating sheet, but our efficiency increased tenfold with our discovery of the now readily obtainable headlamp and 6-Volt dry cell.

The headlamp frees both hands, which is very important when beating and helps in sweeping too. It directs a strong beam of light right where one wants it, but it does produce some eyestrain after a few hours of use. Headlamps of several types are available in hardware and sporting goods stores. Some come with cases which hold 4 regular D-size flashlight batteries. I prefer the longer lasting 6 volt dry cells. These come in 2 popular sizes and the larger (Ca. 5" × 3" × 5"), which costs approximately twice as much, is the better buy as it will last 3 to 4 times longer. Battery life is highly variable, but will be much longer if used for shorter periods (i.e., 3-4 hours/night rather than 6-8). Be sure to unhook 1 terminal when not using the light; shorts can develop or the switch can be flipped on when traveling, and it is very frustrating to run down a battery when in the field, since it may not be possible to replace it that night. But we have found these batteries in Chile, Mexico, and most rural areas in the U. S., because they are used by many hunters and fishermen.

The headlamp often comes with a battery and plastic battery case for attaching the battery to one's belt. This type of case may be acceptable for sedentary hunters and fishermen but they don't hold up for long on me. I recommend a stronger belt case of canvas. It's best to wear this on the belt towards the rear so the cord may pass from the belt to the lamp, behind the arm and shoulder. This helps avoid entanglement in shrubbery or when beating and sweeping. Extra length of cord can be slipped under the head band to reduce this problem as well.

Always carry 1 or 2 extra bulbs when in the field and be sure they are PR 12 or 13, not PR 3 or 4, which are used in most flashlights. Protect the plastic lenses of the headlights from scratching by carrying with the lenses up or protected from rubbing. Also be careful with sprays such as insect repellents; solvents can cause fogging of the plastic that greatly reduces light transmission. The small metal attachments on the cord often break off from frequent flexing of the wire, but it's not necessary to replace them since the wire can be stripped for about 1 inch and wrapped around the battery terminals.

We use an oval beating sheet on a malleable wire rim, which instead of being flat is about 12" deep with a flat bottom and sloping sides. It's about 2.5 ft. long and 1.5 ft. wide, very lightweight, and easily carried under an arm while sweeping. In chaparral, or when collecting on soft short vegetation, the sweepings are dumped into the sheet and spread out to see the insects. Some hide in the debris but many run out to escape, and they can be caught, aspirated, or pushed back down more easily with the steep sided sheet than is possible with a flat sheet. Also many flying and jumping insects will go to the sides of the sheet for a while rather than fly straight up and away, so more of these can be caught. After these fast species are captured, the slower moving insects can be collected from the debris.

With this method, I have taken hundreds and even thousands of many rare species of weevils and good series of many kinds of beetles. It is especially effective for Cerambycidae, Elateridae, Scarabaeidae, Cleridae, Chrysomelidae, Anthribidae, and Curculionidae. Many other groups of beetles and other insects are caught too.

There are, of course, some problems associated with such collecting. Snakes and mosquitoes are 2 of the worst. With a headlamp there is tunnel vision to a certain degree so it's much easier to miss seeing a snake than with a lantern. And mosquitoes abound at night and one attracts many more while moving about than when at a light sheet. Also many insects are attracted to the light on one's forehead and are directed towards the eyes, nose, mouth, and ears as they frantically fly about the light. I recommend covering ears with a hood or plugging them with a small amount of cotton (remember you do want to hear that rattler nearby). Then if you breath through the mouth carefully, you'll get fewer insects up your nose or down your throat. Gnats and small moths are the biggest problem with your eyes, but you can close your eyes to slits when these are especially bad, as happens around aquatic habitats most often.

Such night collecting is especially good in our western arid regions and mountains, but I've had great success with it in New England, the Great Lakes area, the South, and in the tropics of the New World. Try your area, especially in different habitats, and remember that seasonal differences may be important. I've usually had good success from a half hour after dark up to 5 AM on the few occasions I lasted that long, but I usually quit between 1 and 3 AM. Temperature may be important for some groups, but weevils seldom seem to care unless conditions become extreme for a given time. I've done well with temperatures as low as 30° F in the Sierra Nevada, Cascades, and Rocky Mountains. Give the method a fair chance, and I think you may be pleasantly surprised. I certainly have been more than once.—Charles W. O'Brien, Florida A and M University, Tallahassee, Florida.

COLLECTING IN MEXICO

In the company of 3 other biologists (my wife, Kay, Peter A. Meyer, and Bruce S. Heming), I spent the summer of 1972 in Mexico, collecting carabid beetles. Some fine material was collected, and I want to discuss some interesting places that we visited. I also want to mention a remarkable naturalist with whom we became acquainted in Oaxaca.

But first, I will reiterate one of the concluding remarks from the paper on collecting in Mexico by Ball and Whitehead (Coleopt. Bull., 1967, 21(4):137): "the destruction of the native forests is proceeding at an incredible rate." Large tracts of the Lacandone forest that we saw in 1966 are now agricultural fields. In May, 1972, man-made fires cast a pall of smoke over the Chiapan landscape, as tract after tract of forest fell victim to flashing machetes and searing flames. The magnificent mountaintop cloud forests near Pueblo Nuevo are gone except for one on the property of the Seventh Day Adventist mission called "Yerba Buena." The forests of the Ocozocuautla area (*ibid,* 1967: 126-127) are mostly gone. Unbelievably large tracts along the upper reaches of the Rio Grijalva have been cleared of their tropical forests. As I viewed these testimonials to the destructive capacity of man, the words of another tormented person, long since deceased, came to mind: "Father, forgive them, for they know not what they do."

For those who want to obtain a sample of the Mexican beetle fauna, the time to go into the field is now. If the destruction continues at present rates, I imagine a few more years will see the elimination of most of the native vegetational formations, and with them a substantial portion of the fauna. The areas described below are relatively undisturbed, so that probably one can still obtain in them a reasonable representation of the original biota. Montane faunas are especially interesting because study of them has contributed so much to our understanding of evolution at the species level. Although Mexico is richly endowed with mountains, most of the more or less accessible ones have lost substantial portions of their native habitats. Therefore, it is impossible to know much about the distribution and interrelationships of their biota. Consequently, it is especially important to sample as thoroughly as possible those mountains that still have a more or less continuous cover of native vegetation.

Chiapas

In the state of Chiapas, the area that interested me most was the volcano, Tacaná, located on the Mexico-Guatemala border, by road about 40 miles north of Tapachula. The volcano is reached by a paved road which joins Route 200 about 8 miles east of Tapachula, and extends northward to its terminus at Union Juarez. The latter town, on a spur of the volcano, extends from an elevation of about 3,500 feet above sea level to about 6,000 ft. The spur is very steep in that portion occupied by the town, and it is best to leave the vehicle and proceed beyond there on foot. The spur is flanked by 2 large valleys: Barranca Providencia to the east, and an apparently unnamed valley to the west.

Below Union Juarez and in its vicinity, remnants of the native forests and banana trees shade coffee trees from the sun. In the upper reaches of Barranca Providencia are the remnants of pine forest, and this evidently extends upward along the ridges. In the valleys, from about 7,000 ft., are fine tropical cloud forests. At about 9,000 ft., one encounters open grassland, heavily grazed by sheep. At about 10,000 ft., the grassland is invaded by herbs and trees, mainly pine and alder. Still higher, mainly coniferous forest is encountered, and pines extend to within 200 ft. of the rocky summit which is about 13,380 ft.

About 2 days are required to complete the round trip from Union Juarez to the summit, but it is best to allow additional time for intensive collecting. The trail is steep and often very slippery. It is necessary to carry food, water, and warm bedding; at high elevation it becomes uncomfortably cool at night. A guide should be hired in Union Juarez.

Other areas near Union Juarez worth visiting are Pico Gallo to the west, the valley of the waterfall called Sumidero San Antonio, and the upper parts of Barranca Providencia.

Below Union Juarez, the road crosses several torrential streams, and there are many areas adjacent to the road, at the edges of the coffee plantations, where one can park for the night and set up blacklights.

For those requiring accommodations, there is 1 hotel in Union Juarez, "Hotel Colonial Campestre", that is rather elegant-looking from the outside, but inside it is shabby. The staff is inefficient and the place is noisy. There is nothing to recommend this hotel, except its location on the slope of the volcano.

Turning to the Pacific lowlands of Chiapas, along Route 200 about 25 mi. W. of Huixtla is a patch of magnificent rain forest. A road enters the forest to the north of the highway, but access to vehicles is blocked by a heavy log chain suspended between concrete posts. However, one can enter the forest on foot.

Oaxaca

The Pacific coast of Oaxaca is now easily accessible by vehicle. Route 200 is paved, and extends from Acapulco to Puerto Escondido, except for a break at the Rio Verde. Here, a hazardous crossing is made possible by a "jury-rigged" ferry, comprised of a couple of large canoes lashed together and equipped with a deck wide enough to accommodate a single car or small truck. We came to the coast from the city of Oaxaca, across the Sierra Madre del Sur to Puerto Escondido, and we did not cross the Rio Verde. We encountered fine palm forest along Route 200, and collected in it about 3 to 4 mi. W. of the town of Rio Grande.

In the highlands of Oaxaca, we met Boone Hallberg (address: Vivero Rancho Teja, Ixtlan de Juarez, Oaxaca). Now a long-time resident of Mexico, Mr. Hallberg was born in California, and studied botany at the University of Michigan. His superb knowledge of Oaxaca is based on extended botanical forays through the back country, where travel is by foot or on horseback. Anyone contemplating serious work in this state should contact him. He is cooperative, friendly, and has living facilities on his place that can be rented at a reasonable price. Two of the places he suggested we visit were the mountains Yucuyacua and Zempoaltepetl, the 2 highest peaks in Oaxaca. Neither is readily accessible from main roads, and both trips require the services of guides. (In fact, it is advisable to travel in the company of a guide anywhere in the back country of this state. The natives, although not unfriendly, are inclined to be suspicious of total strangers. Suspicions, of course, can lead to unfortunate incidents).

Located on the Atlantic side of the continental divide, Zempoaltepetl is the wetter of the 2 mountains. It is reached by gravel road, from Mitla near Route 190, to the town of Tamazulapam. Here, one leaves the vehicle, obtains a guide to the town of Tlahuitoltepec, and there, another guide for the ascent. The linear distance between these 2 towns is not great, but they are on opposite sides of the Barranca Zempoaltepec, a steep sided valley about 1,000 feet deep. Food and lodging can be obtained in Tlahuitoltepec, but it is necessary to provide bedding, and it is desirable to bring at least some food and cooking equipment. Two to 3 days should be allowed for the round trip.

On the mountain are extensive stands of forest (pine-oak and pine), although there has been much cutting, and corn fields extend far up the slopes. The trail is long and steep, and at the summit (slightly in excess of 11,000 ft.) it can be uncomfortably windy and cold. Between Tamazulapam and Tlahuitoltepec, the trail crosses a number of streams in the vicinity of which are thick stands of alder and oak. And in the bottom of Barranca Zempoaltepec is a beautiful clear, cold river with partially shaded gravel and rubble banks. Thus, one can collect along a transect which extends from the canyon bottom at 5,800 ft. to the top of Zempoaltepetl at more than 11,000 ft.

On the drier Pacific side of the continental divide is Yucuyacua. It is reached from the town of Nundaco at about 7,000 ft., and this, in turn, is about 7 mi. E. of Route 125, and about the same distance south of Tlaxiaco. Detailed directions should be sought in Tlaxiaco, or from a pedestrian on the highway. The pine-oak forests that probably once grew in the vicinity of Nundaco have been replaced by corn fields, but within sight of the village, along the valley slopes, are pine forests, and along the valley bottom are alders. On the mountain, from about 10,000 ft. nearly to the summit one encounters less disturbed pine-oak and pine forests. At the summit is a lush meadow of lupine and various other montane herbs such as *Castelleja,* and large agave plants. From the mountain top, one can see other fairly high peaks not too far distant that look equally inviting.

Another excellent area that we liked is along the road from Ixtlan de Juarez to San Pedro Nolasco. This traverses a number of deep valleys and steep ridges, and these slopes support superb wet to dry oak-pine forests. On this road, we passed through the town of Capulalpam, which is mentioned numerous times in the locality lists for species treated in the Biologia Centrali-Americana. This area was investigated extensively more than 100 years ago by the indefatigable plant collector Theodor Hartweg, whose discoveries were catalogued by Bentham (see R. McVaugh, 1970, Introduction to the Facsimile reprint of George Bentham's "Plantae Hartwegianae", 102 p., 2 maps; J. Cramer). From San Pedro Nolasco, we made a hike of some 12 mi. through cloud forest and oak-pine forest to a place called "Llano Verde".

Each of these areas either produced fine carabids, or had the potential to do so. All should be visited by beetle collectors interested in the Mexican fauna. We will visit them again, hopefully within the next few years. In the meantime, I will be pleased to provide further details to anyone requesting them.—George E. Ball, Department of Entomology, University of Alberta, Edmonton, Alberta T6G2E3.

(*continued from inside front cover*)

departments, provinces, parishes, and/or counties listed. Dates are listed by day, month (in Roman numerals), and last 2 digits of the year. Listing of ecological data is encouraged. Location of specimens should be shown in brackets; if the data is extensive these should be abbreviated as shown and the abbreviations listed in the text.

Any article concerning Coleoptera will be considered. Descriptions of new taxa must contain keys (or be correlated with existing keys) and illustrations. All manuscripts should be typed on 8½×11" opaque white paper with 1 inch margins. They should be typed on one side only and double spaced throughout (including title, footnotes, tables, figure legends, and references). All scientific names should be underlined. Use the following order: title, author, author's address, abstract, body of text, references cited, and figures. All footnotes, tables, and figure legends should be provided on separate sheets and double spaced. Indicate approximate figure and table locations in pencil in the margin of the manuscript.

An abstract should be a concise statement of the facts presented, not *that* they are presented (e.g. list names of organisms, not just that they were discussed or described as new). These abstracts are the key to how your article will be cited in the abstracting journals and should be carefully written.

THE COLEOPTERISTS SOCIETY

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R. L. Wenzel, Field Mus. Nat. Hist., Roosevelt Rd. & Lk. Shore Dr., Chicago, Ill. 60605.

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NOTICES

Notices to appear on this page are a free service to members and subscribers. Such copy will be limited to the back page, the older notices being moved up and replaced with the newest ones at the bottom. The editor reserves the right to reword such notices for brevity, consistency, and clarity.

HYDROPHILIDAE: Presently revising the genus *Hydrochus* from North, South, and Central America, including the Antilles. Request loan of any material from the Western Hemisphere. John L. Hellman, Ent. Dept., Univ. Maryland, College Park, MD 20742.

TENEBRIONIDAE: Building world-wide reference collection, will purchase or exchange other Coleoptera, Especially desire immature stages. Kirby W. Brown, Peabody Museum, Yale Univ., New Haven, Ct 06559.

HELODIDAE: Revising *Eleodes*, need material from NW, W, SW, & S. Will pay postage. Prefer wet material, but mounted or dry OK. Desire larvae also. G. G. Kennen, 381 N Central Ave., Ramsey, N.J. 07446.

SCARABAEIDAE: Wanted, various species of ***Megasoma,*** male and female, major and minor forms. Will exchange pairs of ***M. pachecoi.*** Terry W. Taylor, 8529 Norwood Place, Rosemead, CA 91770.

CICINDELIDAE: Interested in obtaining specimens of ***Cicindela hirticollis ponderosa*** Thoms. from area of Veracruz, Mexico. Will exchange other Coleoptera. R. C. Graves, 627 Crestview, Bowling Green, Ohio 43402.

FOR SALE: Malaysian and Indonesian Coleoptera and Lepidoptera (over 900 species), including horned rhinoceros, stag, and long-horned beetles; send for list and prices. Sim Yam Seng, 21 Joon Hiang Rd., Singapore (19), Malaya.

DYTISCIDAE (Bidessines): Revising genera ***Anodocheilus*** and ***Neobidessus*** for tropical America. Will sort from general collections or light trap material, but promise only generic determinations of other Dytiscidae. F. N. Young, Dept. Zoology, Indiana University, Bloomington, Ind. 47401.

SCARABAEIDAE: Working toward a world revision of the Anomalini. Specimens and records needed from all areas, by loan, purchase, or general exchange. Identifications by arrangement, correspondence invited. R.W.L. Potts, California Acad. Sci., Golden Gate Park, San Francisco, CA 94118.

COCCINELLIDAE: North American specimens and locality records of ***Coccinella undecimpunctata*** L. required for distribution study of this species. M. Y. Watson, Dept. Biology, Laurentian Univ., Sudbury, Ontario, Canada.

REPRINTS DESIRED: Now working on the interpretation and integration of available evidences on phylogeny in construction of a phylogenetic classification of Coleoptera. Reprints are requested from specialists in all families. Mohammad Abdullah, Zoologische Staatsammlung, 8 Munich 19, W. Germany.

CARABIDAE: Need material for study of New World ***Philochtus*** (Bembidiini) including ***Cyclolopha.*** G. G. Perrault. 138 Rue Houdan, 92, Sceaux, France.

LUCANIDAE: Buy, sell, exchange all species. Also wanted: collection data and World literature on the family. Chris Adamson, 2030 Bancroft Way No. No. 5, Berkeley, CA 94704.

PYROCHROIDAE: Building world-wide reference collection. Will purchase or exchange for other Coleoptera. Desire all life stages, rearing data, observations, etc.; correspondence invited. Daniel K. Young, Dept. Ent., Michigan State University, East Lansing, MI 48823.

HYDRAENIDAE (Limnebiidae): Revising genera ***Hydraena*** and ***Limnebius*** for Western Hemisphere. Request loan of adults and/or larvae. Philip D. Perkins, Dept. Entomology (Coleoptera), National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560.

WANTED: One copy of ***Biologia Centrali-Americana,*** Coleoptera, Vol. II part 2. T. W. Taylor, 8529 Norwood Place, Rosemead, California 91770.

CARABIDAE: Dr. Gianluigi Alzona, c.so G. Ferraris 108, 10129-TORINO (Italy) would like to exchange ***Carabus, Calosoma, Cychrus*** in U.S.A., Canada, India, Middle East, U.S.S.R., China.

HYDROPHILIDAE: Presently revising the genus ***Anacaena*** of the world. Request loan of any available material. Jarrett L. Cross, Entomology Department, Smithsonian Institution, Washington, D.C. 20560.

WORLD RESEARCH DIRECTORY: Richard L. Jacques, Jr. and Ross H. Arnett, Jr. are preparing a world list of current research projects on Coleoptera. A volume will be published as a companion to the recently published "Directory of Coleoptera Collections." Anyone wishing to have a research project listed should write to R. L. Jacques, Jr., Dept. of Biology, Fairleigh Dickinson University, Rutherford, N.J. 07070.

SCARABAEIDAE: Studying myrmecophilous and termitophilous Aphodiinae. Request loan of New World material especially. Will sort from general scarab collections or from light trap samples. Robert E. Woodruff, Fla. Dept. Agr., P. O. Box 1269, Gainesville, FL 32601.

CERAMBYCIDAE: Preparing checklist of species in Tennessee. Request data from any Tennessee specimens. Hoyt L. Jamerson, Dept. Biology, Memphis State Univ., Memphis, TN 38152.

SCARABAEIDAE: ***Dynastes hercules*** and related species wanted. Interested in variation in size and color, as well as distribution (locality data). Will buy or exchange. Bill Reid, 994 Irene Ct., No. Valley Stream, NY 11580.

LUCANIDAE: Buy or exchange all species. Offer Buprestidae, Carabidae, Cerambycidae, and Scarabaeidae. Antonio Alaimo, Via dei Platani 52, 00172 Roma, Italy.

CERAMBYCIDAE, LUCANIDAE, & SCARABAEIDAE: Will purchase or exchange. R. H. McPeak, 10370 Limetree Lane, Spring Valley, CA 92077.

FREE PUBLICATION: If you are not now receiving "Progress Reports", the newsletter of the North American Beetle Fauna Project, send your name, address, and interest in beetles statement to: Dr. R. H. Arnett, NABF Project, Dept. Biol., Siena College, Loudonville, NY 12211.

FOR SALE: Used insect boxes of various types and sizes and unit pinning trays for Cornell drawers and Calif. Acad. drawers. Write for specifics to R. E. Woodruff, 3517 N.W. 10th Ave., Gainesville, FL 32601.

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THE COLEOPTERISTS BULLETIN

AN INTERNATIONAL JOURNAL DEVOTED TO
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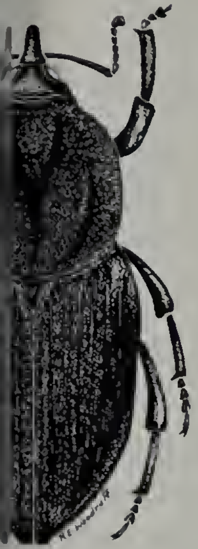

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Specimen label data should be listed in the following manner: MEXICO: State of Veracruz, Fortin de las Flores, 10-VIII-70, I. B. Jones, under bark of **Pinus moctezumae,** 7000ft. [USNM] (2). The number in parentheses indicates the number of specimens. Geographical names are listed in order with largest units first, with states,

Continued inside back cover

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HALIPLUS VARIOMACULATUS, A NEW SPECIES FROM EAST-CENTRAL ILLINOIS (COLEOPTERA: HALIPLIDAE)

Warren U. Brigham and Milton W. Sanderson

Illinois Natural History Survey, Urbana, Ill.

Abstract

Haliplus variomaculatus is described on the basis of 40 specimens from east-central Illinois. A key and illustrations are provided to distinguish it from several similar species, especially *H. deceptus* Matheson, to which it keys in the most recent revision of the genus, and *H. triopsis* Say, which it most closely resembles. Water analysis data are presented for several adjacent ponds similar to those in which *variomaculatus* was collected. A section on ecology discusses the aquatic habitat and species diversity including *variomaculatus* and 10 associated species.

In the course of a survey of the aquatic Coleoptera of Illinois, the authors collected an undescribed species of *Haliplus* from stripmine ponds in east-central Illinois. It belongs to the subgenus *Paraliaphlus* as defined by Wallis (1933).

Haliplus (Paraliaphlus) variomaculatus
Brigham & Sanderson **New Species**

Diagnosis. A medium-sized *Haliplus* with distinctly maculate elytra, medial dark blotch on the anterior portion of the pronotum, undarkened strial punctures, slightly constricted prosternal ridge, metasternum without foveae of any kind, unbeaded anterior pronotal margin, no pronotal plicae, elytron serrate in humeral region, apex of elytron serrate with serrations fading suturally, and digitus of left paramere of male genitalia more than 4 times longer than wide. Keys to *Haliplus deceptus* Matheson in Matheson (1912) and Wallis (1933). Superficially similar to *H. deceptus* and *H. triopsis* Say. From these it differs in the distinctive type of genitalia of the male as well as in differences in elytral pattern. The male genitalia are distinct from the known Nearctic species of *Haliplus* illustrated by Wallis (1933) and subsequently by Mank (1940), Leech (1948, 1957), Gordon and Post (1965), and Brigham and Sanderson (1972).

Haliplus variomaculatus keys to *H. deceptus* in Wallis (1933). Some difficulties are encountered beyond couplet 19, however, and the following modifications are necessary to include the new species:

20.	Color testaceous or fulvous; punctulation moderate; maculation of elytra not or but little confluent or strongly confluent	21
—	Color usually markedly ferruginous; punctulation coarse and deep; maculation of elytra usually strongly confluent (goes to *H. punctatus* Aubé and *H. mutchleri* Wallis)	23

21. Aedeagus of male bent abruptly downward in apical fifth (Fig. 2C) .... *H. triopsis* Say

— Aedeagus of male almost evenly curved from base to apex (Fig. 1E) 22a

22a. Size larger, usually over 3.5 mm long; blotch on anterior margin of pronotum broad, tapering, approaching or exceeding width of base of head (Fig. 2A) .... *H. pantherinus* Aubé

— Size smaller, usually less than 3.25 mm long; blotch on anterior margin of pronotum square or oval, width usually less than width between eyes and never more than slightly greater than width between eyes (Fig. 1B) 22b

22b. Basal black border of elytron narrow; sutural stripe narrow, sometimes not even reaching subsutural row of small punctures; elytral blotches not or but little confluent; apex of right paramere of male genitalia broadly rounded (Fig. 2B), with a few fine setae, apical three-fifths with many fine punctures .... *H. deceptus* Matheson

— Basal black border (B) of elytra rather wide (Fig. 1A); sutural stripe frequently, though not always, attaining 1st row of strial punctures; elytral blotches frequently strongly confluent (Figs. 1A and 1C); apex of right paramere of male genitalia more sharply rounded (Fig. 1D), with a few strong setae, apical two-fifths with few punctures .... *H. variomaculatus* new species

Holotype Male. Ovate, widest at or near the posterior margin of the posthumeral discal blotch (PoHD). Greatest width 1.83 mm; greatest length 3.23 mm.

Head. Maximum width of head through eyes 0.76 mm; minimum width of head between eyes 0.30 mm; punctures uniformly distributed on front and vertex except for a small impunctate area between posterior margins of eyes; eye ringed with narrow dark margin, rest of head testaceous (Fig. 1B).

Pronotum. Width at apex 0.76 mm; width at base 1.30 mm; length along midline 0.73 mm; discal punctation coarse behind anterior margin, finer elsewhere; impunctate area on each side of midline medially; scutellar region impunctate; dusky medial blotch anteriorly, rest of pronotum testaceous (Fig. 1B).

Elytra. Humeral margin serrate; apex serrate, serrations fading suturally; apex only slightly sinuate; strial punctures undarkened, pit-like, the rows uninterrupted; a row of fine punctures between the strial rows, regularly spaced; 2 rows of fine punctures between the 1st strial row and the sutural margin; elytral fuscous markings distinct against a testaceous background, less darkened anteriorly, distributed as follows (Fig. 1A): (1) basal border (B) of elytra fuscous from beyond 5th stria to suture, joining sutural stripe; (2) suture (S) with fuscous border which does not reach the 1st stria, but which reaches the 2 subsutural rows of punctures, expanded at apex into an arrowhead-like apical blotch (A); (3) medial basal blotch (MB) slightly longer than wide, extending from 3rd to 4th striae, joined to basal border; (4) medial sutural blotch (MS) longer than wide, joined to sutural stripe and extending to 2nd stria, extended toward premedial discal blotch (PrMD); (5) posthumeral discal blotch (PoHD) as wide as long, extending from 6th to 8th striae; (6) premedial discal blotch (PrMD) as wide as long, extending from 3rd to 5th striae, extended toward medial sutural blotch (MS); (7) medial discal blotch (MD) longer than wide, extending from 4th to 6th striae, joined by narrow lobe to the postmedial discal blotch (PoMD); (8) postmedial discal blotch longer than wide, extending from 1st to 2nd striae, joined by narrow lobe to sutural stripe and to medial discal blotch (MD); (9) medial submarginal blotch (MSm) wider than long, extending from 7th to 10th striae; (10) postmedial submarginal blotch (PoMSm) longer than wide, extending from 7th to 10th striae. All blotches separated except as noted above. Blotch designations and abbreviations used above and in Fig. 1A follow Brigham and Sanderson (1972) except that their final "b" was dropped here in the abbreviations (example: medial sutural blotch, their msb, becomes MS), and their basal blotch, bb, has been redesignated the medial basal blotch, MB.

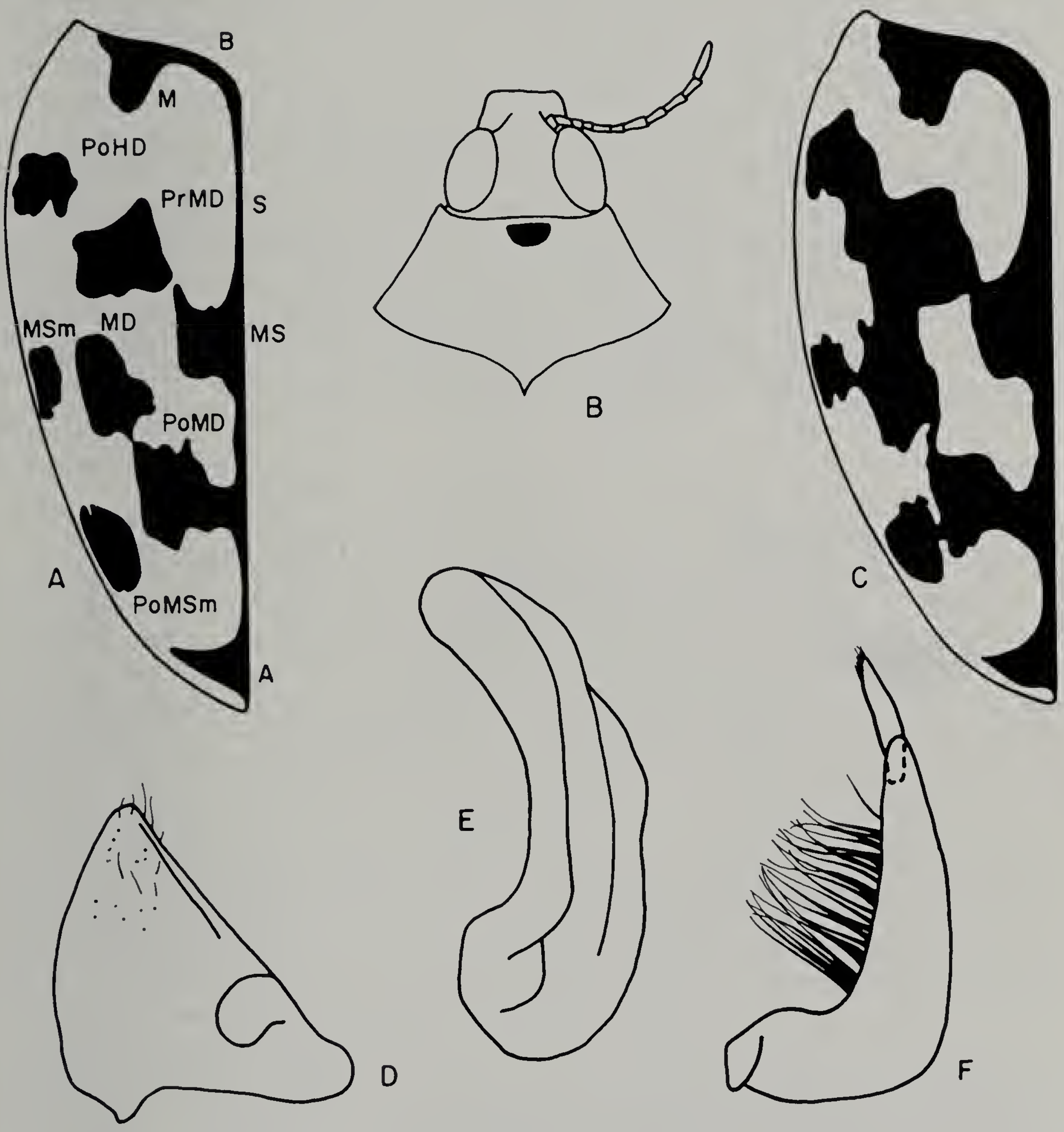

Fig. 1. *Haliplus variomaculatus* new species, holotype male: A. left elytron: B. head and pronotum, dorsal aspect; male genitalia: D. right paramere; E. aedeagus; F. left paramere. Paratype female: C. left elytron.

Venter. Width of prosternum at apex 0.33 mm, at base 0.32 mm, at constriction between front coxae 0.27 mm, obscurely margined, punctures coarser laterally; apex of metasternal process depressed, below base of prosternal process, with an impunctate area medially, without pits or foveae of any kind; last sternite impunctate anteriorly, with a few coarse punctures posteriorly; hind coxa rounded posteriorly, punctures becoming finer and more abundant posteriorly; trochanter of middle leg impunctate, shining; internal face of posterior tibia without longitudinal setigerous striole; basal 3 segments of fore and middle tarsae each enlarged toward apex, the inner apical angles somewhat produced, middle 3 segments densely set with specialized setae; entire venter testaceous except prosternal and metasternal processes, joints of legs, and tarsae which are ferruginous.

Genitalia. Aedeagus (Fig. 1E) about 4 times longer than wide, dorsal lobe continuing along three-fourths of aedeagus, a 2nd lobe continues almost to apex, entire aedeagus curving ventrally from base to apex; right paramere (Fig. 1D) triangular, longer than wide, convex on outer margin, apex sharply rounded, with a few strong setae, apical two-fifths with a few punctures; left paramere (Fig. 1F) concave on inner margin, with long setae, digitus more than 4 times as long as wide, with a dense tuft of setae at the oblique apex.

Allotype Female. Similar to holotype except in color pattern which varies as follows: basal border of elytron and pronotal blotch less darkened and less clearly defined; postmedial discal blotch free from sutural stripe and from medial discal blotch; medial sutural blotch joined to premedial discal blotch by a narrow lobe; fore and middle tarsae lack specialized setae; and basal 3 segments of fore and middle tarsae not produced at the inner apical angles. Size of allotype almost exactly that of holotype.

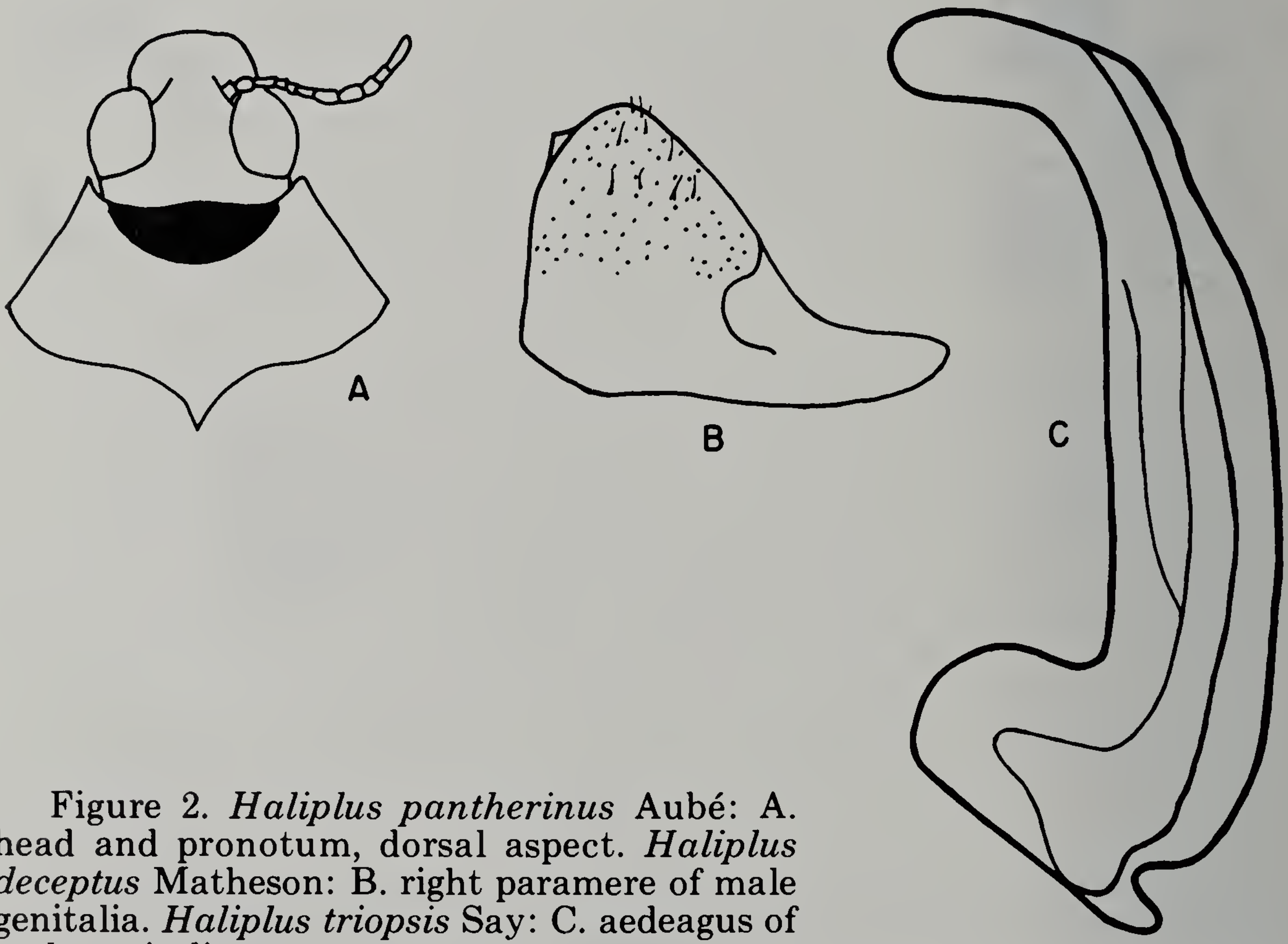

Figure 2. *Haliplus pantherinus* Aubé: A. head and pronotum, dorsal aspect. *Haliplus deceptus* Matheson: B. right paramere of male genitalia. *Haliplus triopsis* Say: C. aedeagus of male genitalia.

Types: Holotype male, allotype female, and 1 male and 4 female paratypes: ILLINOIS, Vermilion County, Kickapoo State Park, pond west of Deep Lake, 18-VI-71, Brigham and Sanderson [Illinois Nat. Hist. Survey]; 6 male and 5 female paratypes: same locality as holotype but 3-VIII-71, Brigham and Sanderson [Illinois Nat. Hist. Survey, Nat. Mus. Nat. Hist., Field Mus. Nat. Hist.]; 4 male paratypes: same locality as holotype but 30-VIII-71, Brigham and A. Gnilka [Illinois Nat. Hist. Survey]; 5 male and 8 female paratypes: a 2nd pond adjacent to type pond, 3-VIII-71, Brigham and Sanderson [W. U. Brigham]; 5 male paratypes: same locality but 30-VIII-71, Brigham and A. Gnilka [W. U. Brigham].

TABLE 1. PHYSICAL AND CHEMICAL CHARACTERISTICS OF 40-YEAR-OLD STRIPMINE PONDS IN KICKAPOO STATE PARK, VERMILION COUNTY, ILLINOIS (SAMPLES FROM 1 M DEPTH).

Parameter	Location		
	Deep Lake	High Lake	Pond No. 6
Total dissolved ionized solids (mg/1)	1378	425	786
pH	7.8	7.9	7.0
Total alkalinity (mg/1 as $CaCO_3$)	140	158	298
Calcium (mg/1 as $CaCO_3$)	472	88	169
Magnesium (mg/1 as $CaCO_3$)	496	161	161
Total hardness (mg/1 as $CaCO_3$)	968	249	330
Silicate (mg/1 as Si)	0.68	4.94	2.34
Orthophosphate (mg/1 as PO_4)	0.02	18.64	0.10
Polyphosphate (mg/1 as PO_4)	22.38	6.96	23.20
Sulfate (mg/1)	1073	82.8	207
Turbidity (JTU)	2.7	1.4	5.5

Ecology. The type series of *Haliplus variomaculatus* was taken from 2 stripmine ponds in Kickapoo State Park, Vermilion County, Illinois. Most specimens were taken from a small bay (2 m wide and 0.5 m deep) of 1 pond with a fine-mesh dipnet. Submerged vegetation here consisted of *Nitella, Potamogeton,* and *Veronica.* Emergent grasses predominated along the periphery of the pond. The 2nd pond contained no *Nitella,* but did contain the related genus *Chara.* Both ponds contained the filamentous alga *Oedogonium.*

While no water analyses were performed on the ponds from which the haliplids were taken, analyses have been performed on stripmine ponds of similar age (approximately 40 years) in the immediate area. These data are believed to reflect the constitution of most of the ponds of that age in the park. Results of these analyses are reproduced in Table 1 to give a more complete picture of the habitat of *Haliplus variomaculatus.*

Little information has been published regarding species associations of Haliplidae. Wilson (1923) reported 2 species of haliplids occurring together in fishponds at Fairport, Iowa. Brigham and Sanderson (1972) found 6 species of haliplids among 41 species of aquatic beetles from a cemetery pond in Niles, Cook County, Illinois. It is therefore notable that 11 species of Haliplidae were taken from a single small bay in 1 of the stripmine ponds reported on here. Results of these collections appear in Table 2.

TABLE 2. HALIPLIDAE TAKEN FROM STRIPMINE PONDS IN KICKAPOO STATE PARK, VERMILION COUNTY, ILLINOIS, DURING 1971.

Species	18-VI-71	3-VIII-71	30-VIII-71
Haliplus borealis LeConte	13	78	24
H. connexus Matheson	0	0	3
H. pantherinus Aubé	0	2	0
H. tortilipenis Brigham and Sanderson	0	2	0
H. triopsis Say	15	28	40
H. variomaculatus new species	7	24	9
Peltodytes edentulus (LeConte)	6	21	21
P. lengi Roberts	3	8	5
P. litoralis Matheson	0	1	1
P. muticus (LeConte)	0	1	0
P. sexmaculatus Roberts	4	24	44
Total	48	189	147

Ascomycete fungi (Laboulbeniales) were noted on the ventral surfaces of 2 of the 24 specimens of *Haliplus variomaculatus* collected on 3-VIII-71. These fungi have been referred to *Hydraeomyces halipli* (Thaxt.) Thaxter by R. K. Benjamin (pers. comm.).

Variation. Gross variation within the type series of *Haliplus variomaculatus* is limited to the elytral maculation. Location and intensity of the blotches appear to be nearly constant, with variation apparent only in the shape of and the degree of coalescence of the blotches. The male genitalia showed insignificant variation in all individuals. Males and females showed some differences in length and width: 22 males ranged in length from 3.1 mm to 3.6 mm (mean length 3.38 mm), and in width from 1.8 mm to 2.0 mm (mean width 1.86 mm); 18 females ranged in length from 3.1 mm to 3.5 mm (mean length 3.30 mm), and in width from 1.8 mm to 2.0 mm (mean width 1.89 mm). Dividing width by length gave a mean value of 0.552 for males and 0.572 for females.

Little significance is attached to the shape of the elytral blotches. Extremes of coalescence are illustrated in Figures 1A and 1C. The 80 elytra in the type series were segregated according to the extent of blotch coalescence into 17 different patterns. It is significant that only 16 of the 40 specimens were symmetrical with regard to elytral pattern.

All elytral patterns showed coalescence of the medial basal blotch (MB) to the basal border of the elytra (B), the medial sutural blotch (MS) and the apical blotch (A) to the sutural stripe (S), and, except for the left elytron of the holotype, the premedial discal blotch (PrMD) to the medial sutural blotch (MS) (Figs. 1A and 1C). The 17 elytral patterns are described in Table 3. Abbreviations for the blotches are as in Figure 1A and in the description of the holotype. Patterns No. 1 and No. 14, the extremes, are illustrated in Figures 1A and 1C, respectively.

TABLE 3. BLOTCH-COALESCENCE DIFFERENCES AMONG THE 17 ELYTRAL PATTERNS FOUND IN THE TYPE SERIES OF *Haliplus variomaculatus* NEW SPECIES (ABBREVIATIONS DEFINED IN TEXT AND ILLUSTRATED IN FIG. 1A).

	Pattern Number																
Coalesced Blotches	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
PoMD and S	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
PoHD and PrMD			*		*	*	*	*	*	*			*	*	*		*
MD and PrMD			*	*		*	*	*	*	·	*		*	*			
PoMD and PoMSm						*	*			*			*	*			
MD and MSm						*		*						*	*	*	
MD and PoMD	*								*		*	*	*	*			
Number of elytra (of 80) with pattern	1	18	15	11	6	5	4	4	3	2	2	2	2	2	1	1	1
Number of occurrences in symmetrical individuals (of 16)	0	5	4	3	0	1	1	0	1	1	0	0	0	0	0	0	0

Coalescence indicated by the symbol "*".

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BOOK REVIEW

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—R. E. Woodruff

* * *

A NEW SPECIES OF *ANTHAXIA* WITH NOTES ON OTHER BUPRESTIDS (COLEOPTERA: BUPRESTIDAE)[1]

Stanley G. Wellso

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Abstract

A new species, *Anthaxia quercicola* is described and the male genitalia and protibia are illustrated. Additional information is provided on the distribution or hosts of 12 other North American buprestids.

A new species of *Anthaxia* is described which may possibly be confused in collections with specimens of A. *quercata* (Fab.) or A. *cyanella* Obenberger.

Anthaxia quercicola Wellso, **New Species**
(Fig. 1-3)

Male. Head and thorax green, elytra aqua with lateral and sutural margins black. **Head** with front broadly concave, indistinctly pubescent with largest punctures within concavity and more distinctly reticulate on upper half of face. Eyes parallel when viewed from front, converging at base of head. Clypeus broadly semicircularly emarginate. Antennae brownish with an aqua cast; first segment elongate and more than twice as long as wide, second segment oval, third segment slightly smaller than segments 4-10 which are similar in size and nearly quadrate, eleventh segment slightly larger than segment 10. Base of head dark with a small indistinct groove. **Pronotum** slightly less than 1.3 times wider than long, widest just behind middle. Anterior margin with a broad median lobe, broadly emarginate on each side; posterior margin linear on each side of middle. Disc with broad impression on each side of midline, deepest between middle of disc and humeral angle. Pronotum indistinctly reticulate with minute pores in each reticulation. Scutellum about as wide as long. **Elytra** impressed transversely near base, laterally on each side; granulate except along sutural and lateral margins which are smoother. Dark smooth lateral margin 3 times broader than sutural margin. Elytra equally wide at basal .125 and 0.5 with a slight constriction between these 2 points and tapering to apex after .625; a ridge laterally along margin and serrate on apical .375 to sutural margin where elytra meet. Ventrally the thorax is aqua-green and abdomen bronze-green. **Legs:** all tibiae serrate internally with a spine arising from each tubercule (Fig. 3). **Size:** length 3.6 mm, width 1.3 mm.

Female. Differing from male in having lower half of face yellow-green with a reddish-purple band above it and a bluish-purple band at base of head. Thorax bluish with a small reddish-purple band anteriorly and a similarly-colored wider band laterally. Elytra purple. Tibiae not serrate. Length 4.1 mm, width 1.5 mm.

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[1] Michigan Agricultural Experiment Station Journal article 6077. Part of a cooperative project between the Entomology Department, Michigan State University, Michigan Agricultural Experiment Station and Agr. Res. Serv., USDA, East Lansing, Mich. 48823.

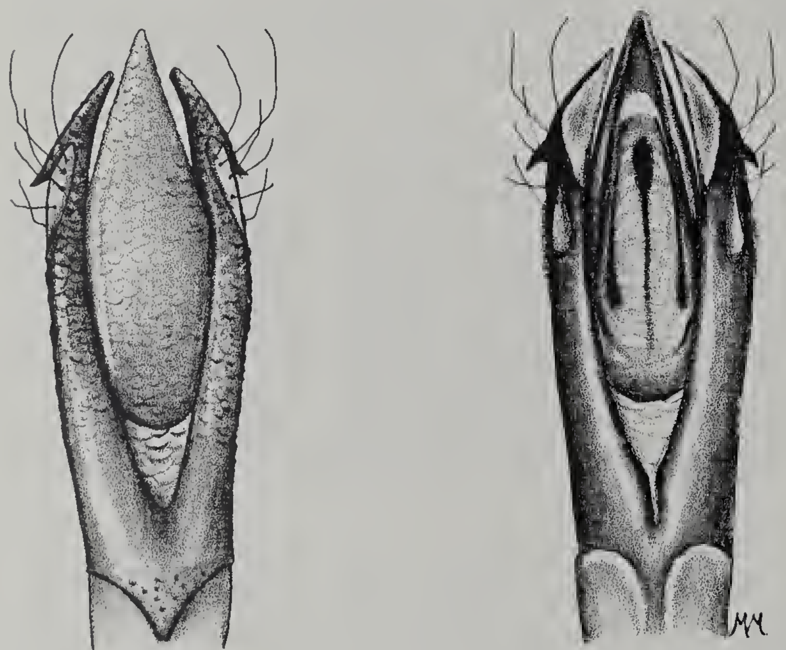
Types: Holotype male: Texas: Easterwood Airport near College Station, 13-IV-64, S. G. Wellso, emerged in a screened insectary from a branch 1.25 inches in diameter of Durand oak, *Quercus durandii* Buckl. (U. S. National Museum). **Allotype female:** Same collection data as holotype [author's collection]. **Paratype males:** Texas: College Station, emerged 16-IV-64, S. G. Wellso, [author's collection]; Texas: Bryan, 8-IV-65 and 13-IV-69, J. C. Schaffner (Texas A&M University Collection). Texas: H4633, Horn Coll, [Academy Natural Sciences, Philadelphia]; Florida: Gainesville, 8-III-29, W.S.B. Collection, [Purdue, Blatchley Collection]; and Michigan: Monroe Co., 8-IV-62, R. R. Dreisbach [Michigan State University Collection]. **Paratype female:** Michigan: Whitmore Lake, 28-VI-56, G. H. Nelson, (G. H. Nelson Collection) collected on *Quercus velutina* Lam.

There is some variation in the male paratypes in the color of the abdomen ventrally. In general, those specimens which were collected in the field are more metallic aqua in color ventrally. It is possible that the specimens from Texas which were killed shortly after emergence had not completely developed their color.

Males can be separated from male *Anthaxia quercata* (see Cobos, 1958) by their smaller size, different coloration and genitalia. Females can be separated from female *Anthaxia cyanella* (see Cobos, 1958) by the entirely blue front of the face in *cyanella.*

HOSTS & DISTRIBUTION NOTES

New hosts and/or new distribution records are presented for 12 N.A. species. Adults were collected in the field or emerged from caged wood in an open-screened insectary at College Station, Texas. Wood was obtained within 3 miles of the insectary in January and February 1964, and was watered each week from April to August. In addition, the duration of the emergence period



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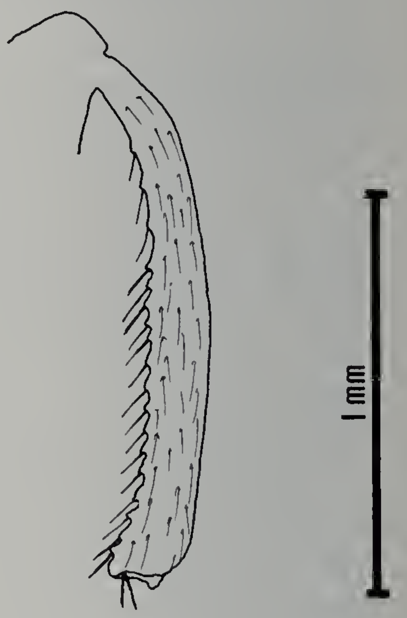

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Fig. 1, 2. Dorsal (1) and ventral (2) surface of male genitalia of *Anthaxia quercicola* n.sp.

Fig. 3. Protibia of male *Anthaxia quercicola* n.sp.

is reported for those species that emerged in the insectary. Unless otherwise noted, I collected all specimens, and they are deposited in my collection.

Actenodes acornis (Say) 1836, Amer. Phil. Soc. Trans. 6:159-160. Adults emerged from pecan, *Carya illinoinensis* (Wang.) K., 4-V-64 to 9-VI-64 at College Station.

Actenodes mendax Horn 1891, Amer. Ent. Soc. Trans. 18:46-47. Emerged from honey locust, *Gleditsia triacanthos* L., between 10-VI-64 and 11-VII-64 at College Station.

Acmaeodera tubulus (Fab.) 1801, Systema Eleutheratorum, Vol. 2: 200. Adults were cut from their pupal cells in pecan on 30-XI-63 and in cedar elm, *Ulmus crassifolia* Nutt., on 10-II-64 at College Station. This species joins *Chalcophorella campestris* Say, *Ptosima gibbicollis* Say, and *Buprestis striata* Fab. which overwinter as adults in pupal cells (Knull, 1925).

Agrilus acaciae Fisher 1926, U.S.N.M. Bull. 145:279-81. Six adults emerged from huisache, *Acacia farnesiana* (L.) Willd., from 29-III-64 to 25-V-64 at College Station. This species was previously reported from Brownsville, Texas.

Agrilus cupricollis Gory 1841, Mon. Bupr. Suppl., 4:240, pl. 40. This species, previously reported only from Florida and Georgia (Franklin & Lund, 1956), was collected with A. *ruficollis* (Fab.) at College Station from 4-IV-64 to 29-IV-64.

Agrilus macer LeConte 1858, Proc. Acad. Nat. Sci., Phila., 10:70. Seventy adults emerged from sugarberry, *Celtis laevigata* Willd., at College Station from 28-V-64 to 4-VII-64 with the peak emergence period being 7-9-VI.

Agrilus pulchellus Bland 1865, Proc. Ent. Soc. Phila., 4:382. Two specimens were collected on fleabane, *Erigeron* sp., at College Station on 11-IX-63 and 21-IX-64.

Agrilus pseudofallax Frost 1923, Canad. Ent. 55:279-80. Thirty adults were collected on honey locust 3 mi W of College Station between 7-IV-64 and 9-V-64. The nearest previously reported locality was Mississippi.

Agrilus tarahumarae Cazier, 1951, Amer. Mus. Novitates, No. 1526, pp. 32-33. This species was described from a unique male from 80 km N. of Chihuahua City, Chihuahua, Mexico on 30-VI-47 and is deposited in the Amer. Mus. of Natur. Hist. collection.

DESCRIPTION OF FEMALE: Differs from male in being larger and more robust with the head and pronotum blackish-bronze and with the elytra aenescent. Length 11.8 mm, width 3.5 mm.

ALLOTYPE, female (writer's collection), Texas, Edwards County, Barksdale, 7-V-61. Ten adults were collected on flowers of *Stillingia* sp. growing adjacent to the Neuces River, by Dr. Horace Burke and the author.

Chrysobothris analis LeConte 1858, Amer. Phil. Soc. Trans. 11:238. Adults emerged from eastern redbud, *Cercis canadensis* L., pecan and sugarberry between 31-III-64 and 24-VIII-64 at College Station.

Chrysobothris arizonica Chamberlin 1938, Pan-Pacific Ent. 14:13-14. A male was collected by sweeping grasses 5 mi NE of Wheatland, Wyoming, 24-VI-65. The nearest previously reported locality was Durango, Colorado.

Chrysobothris ignicollis Horn 1885, Amer. Ent. Soc. Trans. 12:145. Adults emerged from eastern redcedar, *Juniperus virginiana* L., at College Station between 1-III-64 and 27-IV-64.

Acknowledgment

I thank the following individuals and institutions for the loan of specimens: Dr. H. R. Burke (Texas A&M University Collection), Dr. Ray Everly (Purdue University Research Collection), Dr. Henry A. Hespenheide, Dr. G. H. Nelson, Dr. David C. Rentz (The Academy of Natural Sciences of Philadelphia), and Dr. Roland L. Fischer (Michigan State University Collection). I thank Marian P. Mahler for the illustrations.

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Alticinae of Oceania (Coleoptera: Chrysomelidae) by G. Allan Samuelson. 1973. Pacific Insects Monograph 30:1-165; 40 Fig., 1 Table. Available for $8.00 from: Pacific Insects, Bishop Museum, P. O. Box 6037, Honolulu, Hawaii 96818.

Studies of the subtribe Tachyina (Coleoptera: Carabidae: Bembidiini), Part I: A revision of the Neotropical genus *Xystosomus* Schaum by Terry L. Erwin. 1973. Smithsonian Contributions to Zoology 140:1-39; 72 Fig.

A systematic revision and the evolutionary biology of the *Ptomaphagus (Adelops)* beetles of North America (Coleoptera; Leiodidae; Catopinae), with emphasis on cave-inhabiting species by Stewart B. Peck. 1973. Bull. Mus. Comp. Zool. 145(2):29-162; 216 Fig., 21 maps.

Revision of *Bledius* and related genera. Part I. The *aequatorialis, mandibularis,* and *semiferrugineus* groups and two new genera (Coleoptera, Staphylinidae, Oxylelinae) by Lee H. Herman, Jr. 1972. Bull. Amer. Mus. Nat. Hist. 149(2):113-253; 451 Fig., 17 maps.

—R. E. Woodruff

* * *

A NEW *ACANTHOSCELIDES* FROM *INDIGOFERA* (COLEOPTERA: BRUCHIDAE)

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Abstract

A new species of Bruchidae, *Acanthoscelides kingsolveri*, is described. It feeds in the seeds of *Indigofera suffruticosa* and *I. sphaerocarpa* and has a distribution from Texas and Arizona to Costa Rica. Characters to separate it from the very similar *Acanthoscelides submuticus* are given.

Few reports of bruchids feeding in the seeds of the legume genus *Indigofera* have been recorded in the literature. I have only been able to find references to 5 species of *Indigofera* which are attacked by 6 species of Bruchidae (Gyllenhal, 1839; Skaife, 1926; Bridwell, 1918; Zacher, 1952; Prevett, 1967, 1971). The few records of bruchids feeding in the seeds of *Indigofera* are surprising because this plant genus has been reported to contain from 750 to 800 species (Heywood, 1971).

In recent years a new species of *Acanthoscelides* has been reared on a number of occasions from the seeds of *Indigofera* from Texas, Arizona, Mexico, and Central America. This species is described at this time to make the name available for use in biological studies currently in progress. To my knowledge this is the first report of a bruchid feeding in the seeds of *Indigofera* from the New World.

Acanthoscelides kingsolveri Johnson, New Species
(Fig. 1, 2, 3, 4, 5)

Length, pronotum–elytra: 1.5 to 2.4 mm; maximum width: 1.0 to 1.5 mm; maximum thoracic depth: 0.8 to 1.2 mm.

Male: Integument color: Head varying from all black to black with red-orange postocular spot to red-orange with frons and vertex black, labrum red-orange to black; usually antennal segments 1 to 4 or 5 red-orange, remainder brown to black, sometimes all segments red-orange; prothorax usually red-orange varies to all black, sometimes red-orange with median black stripe; elytron varying from all black to all red-orange, usually black with broad median red-orange stripe; legs usually red-orange, sometimes procoxa and lateral margin of hind leg brown, sometimes base of hind femur black; undersurfaces, abdomen, and pygidium usually black but varying thru light brown to red-orange.

Vestiture: Body with white, golden, brown or intermixed recumbent hairs; eye with medial fringe of sparse, white hairs; postocular lobe with short, white hairs; small postocular patch of white hairs; pronotum with narrow median stripe of white hairs on dorsum flanked by contrasting stripes of yellow to brown hairs (Fig. 1); remainder of prothorax with sparse to dense, yellow to white hairs; sometimes with admedial basal patches of dense white hairs;

sometimes vestiture of pronotum uniform white or intermixed white and golden without a definite pattern; elytron sometimes with uniform white or intermixed white and golden pubescence, usually with a pair of brown patches basally, medially, and apically in a characteristic pattern (Fig. 1); sometimes patches faint or a variable number absent, occasionally patches confluent, forming dark bands across elytron; undersurfaces with uniform sparse to dense white hairs; first abdominal sternum usually with basal median circular white pubescent spot; pygidium with uniform sparse to dense white hairs, occasionally basal patches of dense white hairs and/or white median line.

Structure: Head: Usually short and broad, sometimes elongate; densely punctulate; frons usually with median glabrous line or carina extending from frontoclypeal suture to vertex; usually with vague transverse sulcus between upper limits of eyes; frons width about equal to width of eye; ocular sinus .66 to .75 as long as width of eye; distance from base of antennae to apex of labrum about 0.5 as long as distance from upper limits of eyes to apex of labrum; antennal segments of variable shape but usually 1 and 3 filiform, 2 and 4 moniliform, 4 usually shorter than adjacent segments, 5 to 10 eccentric, 11th subacute apically; 5 and 11 about as long as broad, 6 to 10 slightly broader than long; antenna usually reaching to or almost to humerus.

Prothorax: Disk campanulate (Fig. 1); punctulate with many scattered punctations; short median impressed line on median basal lobe; prosternum separating coxae for about 0.8 their length.

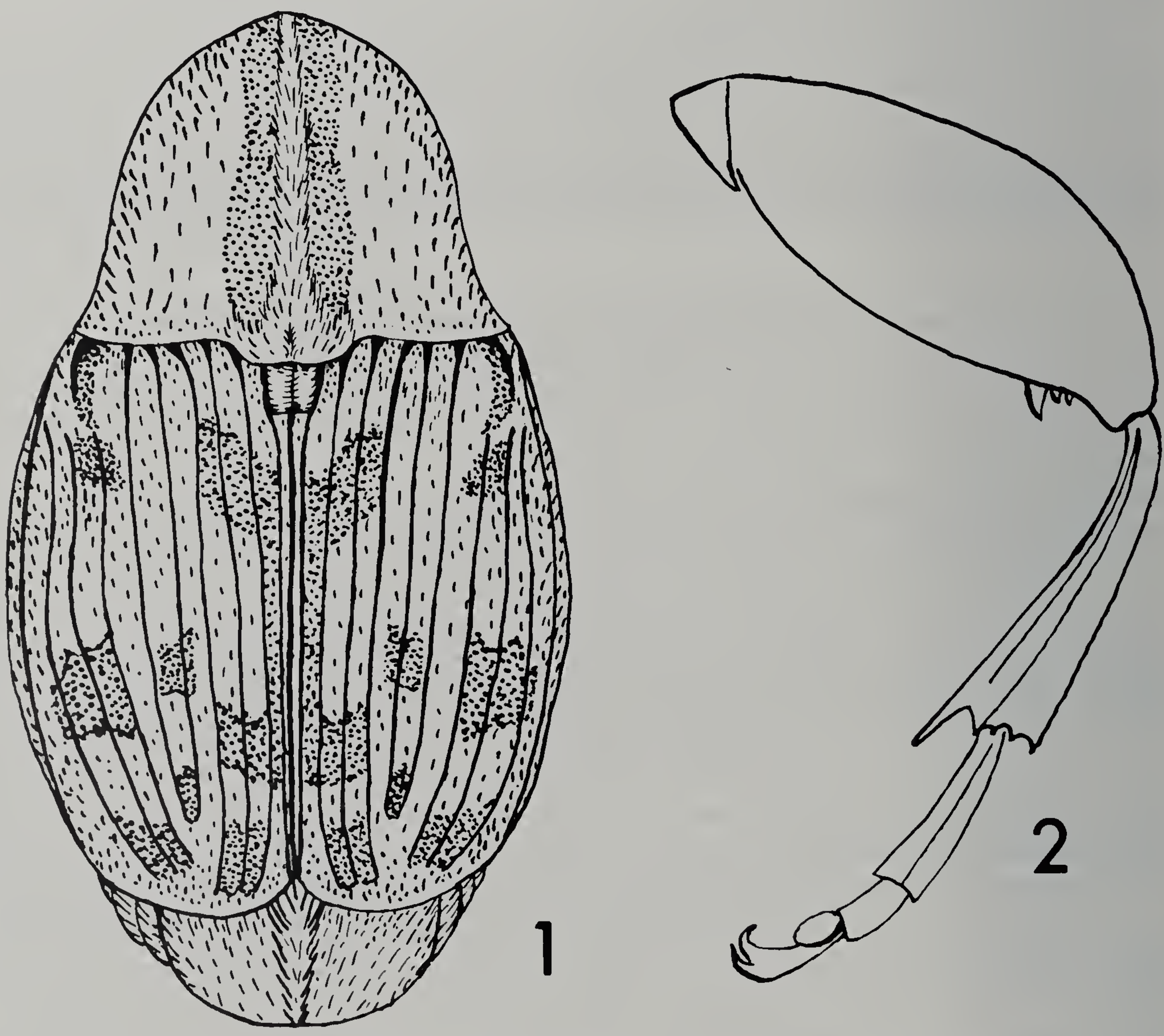

Fig. 1-2: *Acanthoscelides kingsolveri*: 1) dorsal aspect; 2) hind leg.

Meso- and Metathorax: Scutellum small, quadrate, with lateral posterior teeth, clothed with dense recumbent white hairs usually giving quadrate appearance; elytron about twice as long as broad, dorsal surface in an even, gentle convex curve between humerus and medial margin; striae deep, punctate, strial intervals punctulate; striae usually subequal, sometimes striae 3 and 4, and 5 and 6 closer to one another at base than to adjacent striae; humerus punctulate, shiny, glabrous; undersurfaces punctate, punctations becoming more coarse laterally; hind coxa without depression near medial margin, ventral surface in a gentle convex curve from medial margin to lateral margin; hind femur constricted basally and apically, expanded medially to slightly more than width of coxa (Fig. 2); usually faint longitudinal carina on inner ventral surface, sometimes scattered spinules on inner carina; femur armed with a subapical acuminate spine about as long as or slightly longer than width of tibial base and 2 acuminate spines .33 to 0.5 as long as first spine; tibia (Fig. 2) with ventral, lateral, dorso-mesal, and latero-ventral glabrous longitudinal carinae; tibial corona with 3 or 4 spinules, mucro about .33 as long as 1st tarsomere; slight sinus at base of mucro (Fig. 2); 1st tarsomere with ventral, lateral and mesal glabrous longitudinal carinae.

Abdomen: 1st sternum flattened medially, slightly longer than remaining sterna, posterior margin straight; sterna 2 to 4 unmodified, 5th emarginate; pygidium punctate, convex in lateral view.

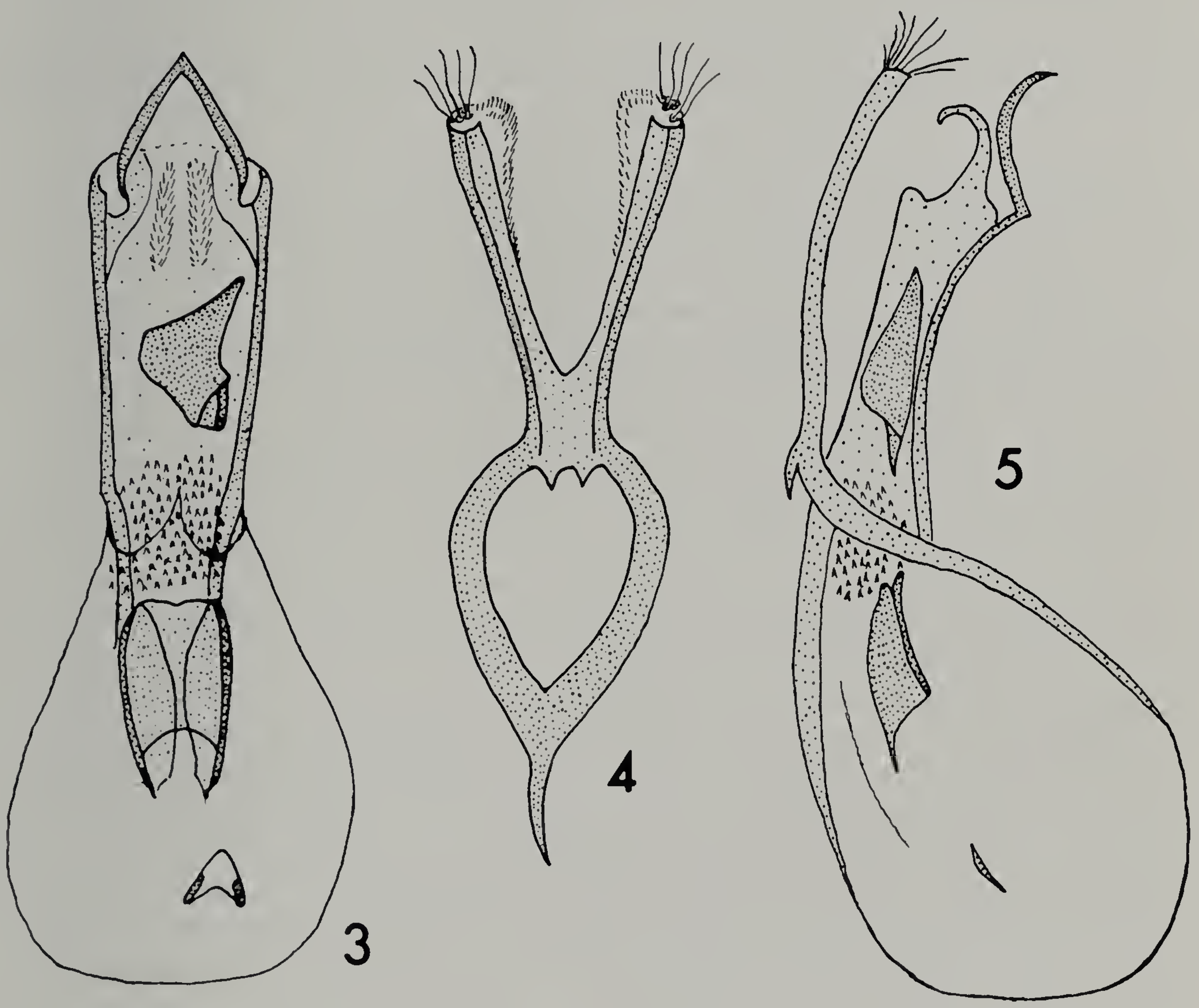

Fig. 3-5: *Acanthoscelides kingsolveri,* male genitalia: 3) median lobe, ventral view; 4) lateral lobes, ventral view; 5) median lobe and lateral lobes, lateral view.

Genitalia: (Fig. 3, 4, 5): Median lobe moderate in length; in ventral view ventral valve pointed apically, lateral margins slightly convex, base almost as broad as apex of median lobe, arcuate in lateral view; 2 faint, paired, setose structures that may be hinge sclerites near apex of median lobe (Fig. 3); armature of internal sac consisting of a large triangular spine about .33 from base, a large, broad, paired structure about .33 from apex and a gonopore sclerite that is usually triangular in shape at apex. Lateral lobes expanded apically, cleft to about 0.8 their length (Fig. 4).

Female: Similar to male but antennae usually shorter, hardly reaching humerus; vestiture of 1st abdominal sternum uniform, without basal median circular white pubescent spot, about as long as remaining sterna; apical margin of last abdominal sternum not emarginate.

Host Plants: *Indigofera* sp.: COSTA RICA: Prov. of Guanacaste, Playas del Coco, 15-XII-70, emerged by 4-III-71, D. H. Janzen. Prov. of Puntarenas, Boca de Barranca, Puntarenas, 10-III-71, D. H. Janzen.

Indigocera (sic): TEXAS: Sutton County, Sonora, 12-IV-38 (collector unknown).

Amorpha (?): MEXICO: State of Nayarit, San Blas, 3-II-64, P.M. Estes.

Indigofera sphaerocarpa Gray: ARIZONA: Cochise County, ca. 5600 ft., Miller Cyn., Huachuca Mts., 6-X-72, C.D. Johnson.

Indigofera suffruticosa Mill.: MEXICO: State of Veracruz, 30 mi. NW Veracruz, 13-VI-68, emerged from 19-VII-68 to 16-X-68, C. D. Johnson; State of Nayarit, 3100 ft., 14 mi. NW Ixtlan del Rio, 11-VII-68, emerged 16-VIII-68, C. D. Johnson; State of Sinaloa, 29 mi. NW Mazatlan, 12-VII-68, emerged from 15-VII-68 to 5-II-69, C. D. Johnson; 34 mi. NW Mazatlan, 12-VII-68, emerged from 15-VII-68 to 9-XII-68, C. D. Johnson. State of Sonora, Alamos, 14-VII-68, emerged from 30-VII-68 to 14-III-69, C. D. Johnson; 6 mi. NW Alamos, 14-VII-68, emerged from 15-VII-68 to 26-III-69, C. D. Johnson; 11 mi. N Guaymas, 15-VII-68, emerged from 19-VII-68 to 26-III-69, C. D. Johnson.

Holotype male, allotype female, and numerous paratypes: MEXICO: State of Sinaloa, 29 mi. NW Mazatlan, 12-VII-68, reared seeds *Indigofera suffruticosa,* #290-68, C. D. Johnson. [USNM #71400]. Other paratypes: ARIZONA: Cochise County, ca. 5600 ft., Miller Cyn., Huachuca Mts., 6-X-72, C. D. Johnson. TEXAS: Sutton County, Sonora, 12-IV-38 (collector unknown); Uvalde County, Nueces Riv., 5 mi. W of Uvalde, 10-VII-41, B. E. White; Uvalde, 11-VII-41, W. F. Barr. MEXICO: State of Veracruz, 30 mi. NW Veracruz, 13-VI-68, C. D. Johnson; State of Nayarit, 3100 ft., 14 mi. NW Ixtlan del Rio, 11-VII-68, C. D. Johnson; State of Sinaloa, 34 mi. NW Mazatlan, 12-VII-68, C. D. Johnson; State of Sonora, Alamos, 14-VII-68, C. D. Johnson; 6 mi. NW Alamos, 14-VII-68, C. D. Johnson; 11 mi. N Guaymas, 15-VII-68, C. D. Johnson. COSTA RICA: Prov. of Guanacaste, Playas del Coco, 15-XII-70, D. H. Janzen; Prov. of Puntarenas: Boca de Barranca, Puntarenas, 10-III-71, D. H. Janzen. Other specimens (not paratypes): MEXICO: State of Veracruz, 27 mi. NW Veracruz, 26-XII-63, L. & C. W. O'Brien; State of Chiapas, 17 mi. W Tuxtla Gutierrez, 24-IV-59, 3000 ft., H. E. Evans; State of Nayarit, San Blas (Fort), 18-XII-63, C. W. & L. O'Brien; San Blas, 3-II-64, P. M. Estes; 4 mi. E San Blas, 27-VIII-65, C. D. Johnson; State of Sinaloa, 5 mi. NE Copala, 25-VIII-65, C. D. Johnson.

Holotype, allotype and numerous paratypes deposited in the U. S. National Museum of Natural History. Paratypes retained in the collection of the author and also deposited in the following collections: California Academy of

Sciences, San Francisco; Canadian National Collection of Insects, Ottawa; Field Museum of Natural History, Chicago; Entomology Department, Texas A & M University, College Station; Los Angeles County Museum of Natural History; and the Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.

Discussion. As would be expected with a species that has a distribution from the United States to Central America, there is considerable morphological variation in color and size. The most common ground color of the integument is reddish-orange. The few specimens collected in Arizona and in Veracruz state, Mexico, were almost all black. Whether most specimens from these areas are mostly black or whether this color difference is due to sampling error is not known.

The specimens from Costa Rica and Texas are larger in size and tend to have pubescence of a more uniform color on the elytra than specimens from other parts of the range of the species. The larger size is probably due to larger seeds of the host plants in which the insects developed.

Specimens of *kingsolveri* have been reported to breed only in the seeds of *Indigofera* and *Amorpha*. The report of *Amorpha* as a host plant could be in error and should be verified.

It is most similar in its external structure and in its male genitalia to *Acanthoscelides submuticus* (Sharp) (see Johnson, 1970: 87-89 for description, synonymy, host plants and distribution). Their similar structures and habits of feeding in the seeds of the somewhat similar plants in the Papilionoideae probably indicate that they have a monophyletic origin.

A. submuticus and *A. kingsolveri* differ in several ways, however. Externally, elytral striae 3 and 4 of *submuticus* are usually closer at their bases than they are to adjacent striae while those of *kingsolveri* are usually subequal (Fig. 1). In *submuticus* the subapical hind femoral spine is slightly shorter than the width of the tibial base and there are usually 3, sometimes 2, smaller spines near the large spine, while in *kingsolveri* the subapical spine is as long as or longer than the width of the tibial base and there are only 2 smaller spines associated with it (Fig. 2). *Acanthoscelides submuticus* usually lacks lateral and latero-ventral carinae on the hind tibia and always lacks lateral and mesal carinae on the first hind tarsomere while *kingsolveri* has strong carinae on both these structures (Fig. 2).

The male genitalia are similar in general structure but the ventral valve of *submuticus* is smaller and less pointed than *kingsolveri. A. submuticus* has an internal sac in which the only armature is a large pubescent structure while *kingsolveri* (Fig. 3, 4, 5) has a large, paired structure and a large triangular spine in its internal sac. The lateral lobes of *submuticus* are cleft to .625 their length while those of *kingsolveri* are cleft to about 0.8 their length. A pair of faint, setose structures are located near the apex of the median lobe of *kingsolveri* (Fig. 3). These are everted when the internal sac everts and may be hinge sclerites, structures not found in *submuticus* and most other *Acanthoscelides.*

This species is named for Dr. John M. Kingsolver, a leader in research on the systematics of the Bruchidae.

ACKNOWLEDGMENTS

I thank Dr. Rodolpho Hernandez Corzo, Director General, Dirección General de la Fauna Silvestre, Mexico, D.F., for granting permission to collect specimens in Mexico. Some specimens for this study were lent to me by J. M. Kingsolver of the U. S. National Museum of Natural History and H. B. Leech of the California Academy of Sciences. Their help is gratefully acknowledged. Financial assistance was provided by the Entomology Research Division, U. S. Department of Agriculture, under Grants 12-14-100-9187(33) and 12-14-100-9970(33).

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TAXONOMIC RELATIONSHIPS AND BIOLOGY OF *MACRORHOPTUS* (CURCULIONIDAE)[1]

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Abstract

Macrorhoptus is excluded from the tribes with which it has previously been associated (Anthonomini, Bradybatini and Endaeini) by a combination of larval, pupal and adult characters. The genus is provisionally retained in Anthonominae without assignment to tribe. All species of *Macrorhoptus* for which biological information is available utilize malvaceous plants as hosts, completing larval development in the fruit capsules. The larval and pupal stages of the genus are illustrated for the first time.

Introduction

As part of revisionary studies currently being conducted on *Anthonomus* Germar, it has been necessary to review the taxonomic relationships of all categories above the species level which are (or have been) included in the subfamily Anthonominae. The problem concerning the relationship of *Macrorhoptus* LeConte to other genera in the subfamily is especially perplexing, although some new data on the adult and immature stages of species of *Macrorhoptus* help to clarify certain points. The significance of larval, pupal, and adult characters, as they relate to the taxonomic position of *Macrorhoptus,* is discussed in the present paper. Since little has been published on the biology of *Macrorhoptus,* some observations made during the study are also presented. A thorough revision of *Macrorhoptus* is needed, as there are undescribed species in the genus, and correct determination of certain described species, by use of existing keys, is extremely difficult, if not impossible. Furthermore, evaluation of what appears to be a rather high degree of infraspecific morphological variation, in some species, has not yet been attempted. Involvement in taxonomic investigations of the tribe Anthonomini (from which *Macrorhoptus* is herein excluded) prevents me from undertaking a revision at this time.

Macrorhoptus has previously been recorded only from North America; however, the genus is much more widely distributed; specimens (apparently undescribed) assignable to it have recently been examined from Argentina. Another specimen seen from Panama represents either an aberrant species of *Macrorhoptus* or a closely related and undescribed genus. Additional collecting in Central and South America on probable hosts (malvaceous plants) would likely greatly extend the known range of the genus as well as provide more material on which to base taxonomic decisions.

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[1] Technical article no. 9961. Department of Entomology, Texas Agricultural Experiment Station, Texas A&M University.

TAXONOMIC HISTORY

Macrorhoptus was originally described to include 1 species, *M. estriatus* LeConte, and at the time it was placed in the tribe Anthonomini (LeConte 1876). LeConte mentioned that, in the classification scheme of Lacordaire (1863), *Macrorhoptus* would be placed in the group Ceratopides after *Acanthobrachium* Boheman (now *Ceratopus* Schoenherr). Most subsequent authors (Dietz 1891; Blatchley and Leng 1916; Sleeper 1957; Kissinger 1964; Hatch 1961) followed LeConte in including *Macrorhoptus* in Anthonomini. Schenkling and Marshall (1934) and Blackwelder (1947) assigned *Macrorhoptus* to the tribe Bradybatini where it was placed next to *Pseudanthonomus* Dietz. Various species of the genus were treated taxonomically by Dietz (1891), Sleeper (1957), and Hatch (1971).

TAXONOMIC RELATIONSHIPS

Macrorhoptus differs from genera of the tribe Anthonomini by the characters listed in Table 1. The larval and pupal characters enumerated therein have not heretofore been discussed in the literature. Characters of both the adult and immature stages provide good evidence that *Macrorhoptus* should not be included as a member of the tribe Anthonomini. The terminal anus and unicameral abdominal spiracles of *Macrorhoptus* larvae contrast with the subterminal anus and bicameral spiracles of Anthonomini. Considerable weight is generally given to these characters in determination of relationships among the higher categories of Curculionidae. The difference in the 2 groups in the number of larval postdorsal setae is of value as a key character, but probably is of little significance in measuring phylogenetic relationships. Postdorsal setae 2 and 4 are absent in *Macrorhoptus*; these setae are present but smaller (frequently much smaller than postdorsal setae 1, 3, and 5) in the Anthonomini. Although 3 dorsal folds can usually be counted on some of the abdominal segments of larvae of *Macrorhoptus,* these folds are always poorly developed. Larvae of Anthonomini have 3 more or less strongly developed folds on most of these segments.

The most distinctive difference between pupae of the 2 groups is that *Macrorhoptus* pupae have femoral setae while those of Anthonomini do not. In addition, *Macrorhoptus* pupae do not bear setae on the disc of the prothorax as do pupae of the Anthonomini. The posterior processes which are so prominent on pupae of all (of those known) Anthonomini (except *Coccotorus* LeConte and *Furcipus* Desbrochers) are absent in *Macrorhoptus.*

Some adult characters of *Macrorhoptus* are also of apparent value in determining the relationships of the genus. The postocular lobes vary in size among the various species of *Macrorhoptus,* but they are always present; these lobes are absent in the true Anthonomini. The presence of a dorsal comb on the metatibia of *Macrorhoptus* readily separates this genus from the genera of Anthonomini. Additional differences involving the scrobe, lateral rostral groove, and prosternum are listed in Table 1 and figured.

The immature stages have not been described for other genera and tribes with which *Macrorhoptus* should be compared and, consequently, comparisons must be made entirely on adult characters. *Macrorhoptus* obviously does not belong to the tribe Bradybatini to which it is assigned by Schenkling and Marshall (1934) and Blackwelder (1947). In fact, Bradybatini, as conceived by Schenkling and Marshall, is an extremely poorly defined assemblage

TABLE 1. COMPARISON OF *Macrorhoptus* WITH GENERA OF THE TRIBE ANTHONOMINI.

Stage and Character	***Macrorhoptus***[2]	**Genera of Anthonomini**[3]
ADULT		
(1) scrobes	well defined (Fig. 2)	poorly defined or absent
(2) lateral rostral groove	absent	present
(3) prosternum	emarginate (Fig. 4)	not emarginate
(4) prothoracic post-ocular lobes	slight to well defined (Fig. 2)	absent
(5) metatibiae	with dorsal comb (Fig. 3)	without dorsal comb
LARVA		
(6) anus	terminal (Fig. 1a,b)	subterminal
(7) postdorsal setae	3 pairs	5 pairs
(8) abdominal spiracles	unicameral	bicameral
PUPA		
(9) ninth abdominal segment	without posterior projection (Fig. 5)	usually with posterior projections
(10) pronotal setae	posteromedian setae absent; posterolateral series confined to lateral margins of pronotum	posteromedian setae present; posterolateral series extends on to the disc of pronotum
(11) femoral setae	present	absent

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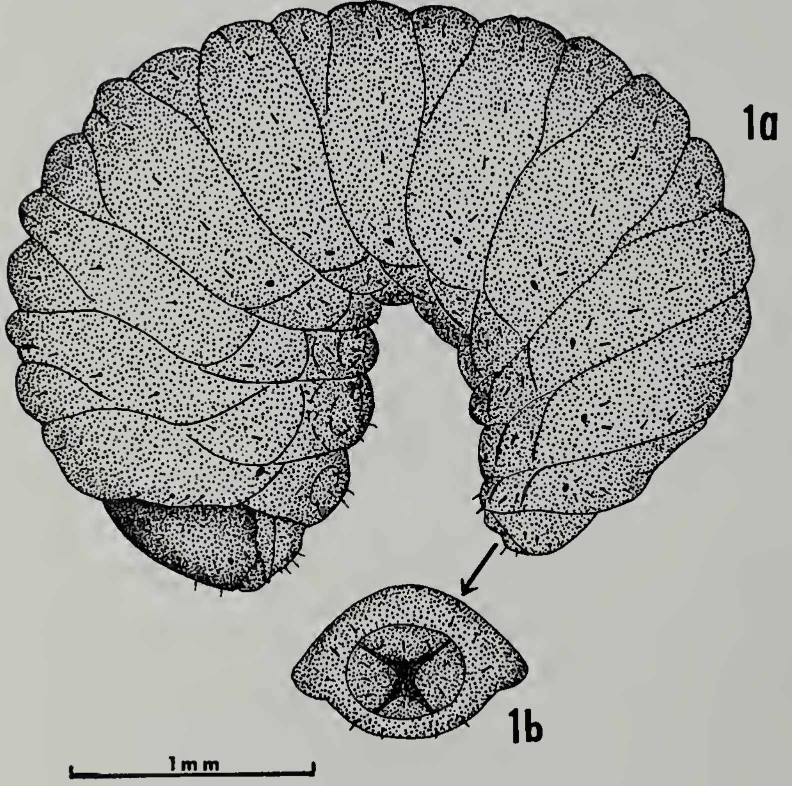
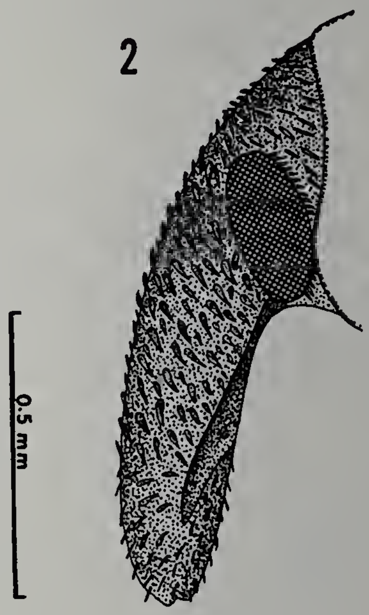
[2] Adults of all known species of *Macrorhoptus* examined. Information on larvae and pupae obtained from study of *M. estriatus* LeC., *M. sphaeralciae* Pierce, and *M.* sp. (probably undescribed).

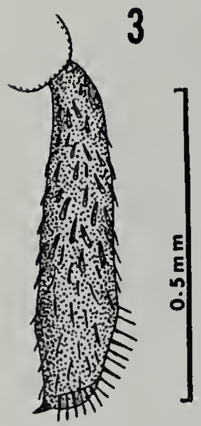
[3] Adults of the following genera examined: *Anthonomopsis* Dietz, *Anthonomus* Germar, *Brachyogmus* Linell, *Cionomimus* Schenkling and Marshall, *Chelonychus* Dietz, *Cionopsis* Champion, *Coccotorus* LeConte, *Epimechus* Dietz, *Furcipus* Desbrochers, *Lonchophorus* Chevrolat, *Magdalinops* Dietz, *Nanops* Dietz, *Pseudanthonomus* Dietz, *Smicraulax* Pierce, *Tachypterellus* Fall and Cockerell.

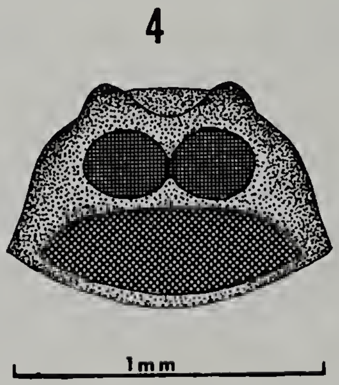
Pupae of 49 species of 9 genera (Burke 1968; Burke and Hafernik 1971) and larvae of 51 species of 10 genera (Ahmad and Burke 1972) have been examined.

of genera, several of which (e.g., *Cionopsis* Champion, *Cionomimus* Schenkling and Marshall, *Pseudanthonomus* Dietz and *Smicraulax* Pierce) actually belong in Anthonomini. *Bradybatus* Germar differs most significantly from *Macrorhoptus* in having lateral rostral grooves and lacking postocular lobes. *Bradybatus* also has a 6-segmented funicle while that of *Macrorhoptus* is 7-segmented.









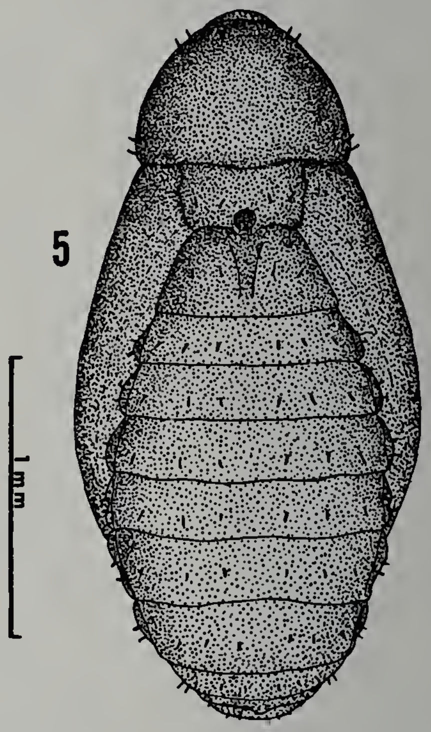


Fig. 1. Fullgrown larva of *Macrorhoptus sphaeralciae:* a) lateral view; b) posterior view (enlarged) of segment 9 and anus.

Fig. 2-4. *Macrorhoptus estriatus:* 2) lateral view of head, rostrum, and anterior margin of prothorax, male; 3) lateral view of hind tibia; 4) ventral view of prothorax.

Fig. 5. Pupa of *Macrorhoptus sphaeralciae,* dorsal view.

Macrorhoptus may also be compared with genera placed in the tribe Endaeini, another group whose constitution and subfamilial affinities are much in doubt. Schenkling and Marshall (1936) placed Endaeini in the subfamily Prionomerinae, although Marshall (1933) had earlier referred *Endaeus* Schoenherr to Anthonominae. Klima (1934) assigned *Endaeus* to the subfamily Tychiinae. Endaeini was treated as a tribe of Anthonominae by Kissinger (1964). No extensive study has been made of the genera usually placed in Endaeini, but a preliminary survey revealed a few characters which some of these genera share in common. The scales on the prothorax are arranged transversely, the claws are appendiculate, lateral rostral grooves (in addition to the scrobes) are present, and several genera (*Endaeus, Ochyromera* Pascoe, *Thysanocnemis* LeConte, and *Neotylopterus* Hustache) have at least some of the abdominal sterna angulated laterally. *Macrorhoptus* differs from this group of genera by having the dorsal pronotal setae longitudinally or diagonally arranged, tarsal claws toothed, lateral rostral groove absent, and the abdominal sternal sutures straight at the sides.

The differences mentioned above indicate that *Macrorhoptus* is not closely related to any of the genera presently placed in Anthonomini, Bradybatini, and Endaeini, and it should not be assigned to either of these tribes. There is some justification for erecting a new tribe for *Macrorhoptus*; however, considering the present poor state of knowledge of the tribal classification of most Curculionidae, I feel that no useful purpose would be served by doing so. *Macrorhoptus* should be retained in Anthonominae for the present, although the evidence is by no means conclusive that the genus is even a member of the subfamily. Assignment to a tribe should be deferred until more information has been accumulated on a wider range of genera with which *Macrorhoptus* should be compared.

BIOLOGY

Biological information on *Macrorhoptus* is scarce in the literature and consists mostly of incidental observations made on the hosts and developmental sites of a few species. Pierce (1907) was the first to publish on the biology of the genus, noting that the eggs of *M. estriatus* are deposited in the seed capsules of *Callirhoe involucrata* (Torr.) Gray in Texas. According to Pierce, the larva feeds on 2 carpels of the fruit and, upon becoming mature, pupates in the feeding cavity. Pierce (1908) described *M. sphaeralciae* from specimens reared from the capsules of *Sphaeralcea angustifolia* (Cav.) D. Don in Texas. Sleeper (1957) described *M. sidalceae* from specimens "bred from seeds of *Sidalcea hendersoni*" in British Columbia. Stoner (1968) and Hatch (1971) mentioned the association of *M. hispidus* Dietz with *Sphaeralcea* spp., and I have examined specimens reared from fruit capsules of *Sphaeralcea Fendleri* Gray and *Sphaeralcea Emoryi* Torrey in Arizona. No host records have been published for the remaining 3 described species of *Macrorhoptus*. All of the above-mentioned plants are Malvaceae and these reports, along with my own observations, indicate that *Macrorhoptus* is confined to members of this family as hosts.

Some additional biological information has been accumulated on *M. estriatus*. Eggs are not always deposited in the capsule as Pierce (1907) noted, although the majority are probably placed there. Observations made mainly during May, 1971 at College Station, Texas revealed that *M. estriatus* sometimes deposits eggs in the stems of *C. involucrata* 3 or 4 mm below the seed capsule. When plants were first examined on 30 April, eggs were numerous in the stems. The egg puncture is quite evident and usually only 1 egg is deposited in each stem, although 1 plant examined contained 5 eggs in a single oviposition hole. A few newly hatched larvae were also present at the time. The larvae apparently start burrowing upward soon after hatching, moving through the pith channel into the base of the capsule rather than tunneling through the more solid tissue of the stem. On the same plants, larvae were found in capsules where there was no evidence of entry through the stems; in these cases the females obviously inserted eggs directly into the capsules.

At the same time I made observations on the life history and habits of another species which is apparently undescribed. It is obviously most closely related to *Macrorhoptus griseus* Sleeper and is easily distinguished from all other members of the genus by the straight, slender rostrum of the female. It was first found on *Malvastrum aurantiacum* (Scheele) Walp during May 1970 near Bryan, Texas. By early June, large numbers of adults were present on the plants. On 10 June, eggs, some first instar larvae and a few fullgrown larvae occurred in the fruit capsules. Eggs are deposited most frequently through punctures in the tops of the carpels, although sometimes the eggs are placed in the outer edges of the carpels. The eggs are normally elongate but are often quite misshapen, assuming the shape of the puncture in which they are placed.

Newly hatched larvae begin feeding on seeds. When a seed is consumed, the larva tunnels through the carpel wall and feeds on the adjacent seed. Several larvae may complete development in the same capsule. The weevil larva packs the frass in one end of the cavity or around the sides of the cavity. Pupation occurs in the carpel in the cavity formed by feeding of the larva. The adult emerges through a hole chewed in the side of the carpel wall.

Acknowledgment

I wish to thank Dr. D. M. Anderson, Systematic Entomology Laboratory, USDA, Washington, D.C. for assistance in interpreting the larval characters of *Macrorhoptus*.

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BOOK REVIEWS

ISLANDS

The following are part of a beautiful series of books dealing with islands of the World. Twelve volumes have already been published, and several more are in preparation by David & Charles and Stackpole Books. The four listed here are available from the latter at Cameron & Kelker St., Harrisburg, Pa. 17105.

Grand Bahama by P. J. H. Barratt. 1972. 206 p., 33 photos, 2 maps, gazeteer, bibliography. $8.95.

The Falkland Islands by Ian J. Strange. 1972. 256 p., 29 photos, 4 maps, bibliography, with an excellent 34-page chapter on natural history. $8.95.

Corsica by Ian Thompson. 1972. 212 p., 25 photos, 9 maps, bibliography. $7.95.

Vancouver Island by S. W. Jackman. 1972. 212 p., 36 photos, 2 maps, bibliography. $7.95.

These books serve as excellent guides to many interesting and exciting islands. They would be of special interest to collectors, zoogeographers, or someone with just the urge to travel.—R. E. Woodruff

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BOOK REVIEW

Entomologische Arbeiten aus dem Museum G. Frey. 1973 (Oct.). Vol. 24, 366 p.; edited by Dr. Gerhard Scherer; published by the Frey Museum, Tutzing bei München, Germany (available on exchange);

Contents:

SCARABAEIDAE: Decelle, J. Une nouvelle espèce d'*Oreotrogus* d'Afrique orientale (p. 240-243).
  Endrödi, S. Monographie der Dynastinae 5. Tribus: Oryctini (Melolonthinae) (p. 1-87).
  Frey, G. Beschreibung zweier neuer *Onthophagus*-Arten und des Allotypus zu *O. volucer* aus Bangla Desh (p. 101-103).
  Frey, G. Neue afrikanische *Adoretus*-Arten (Rutelinae) (p. 284-289).
  Frey, G. Neue afrikanische und indische Sericinae (Melolonthinae) (p. 244-248).
  Frey, G. Neue Macrodactylini (Melolonthinae) (p. 255-279).
  Frey, G. Neue orientalische Melolonthiden (p. 232-239).
  Frey, G. Neue westafrikanische *Onthophagus* aus dem Museum Budapest (p. 311-314).
  Frey, G. Synopsis der südamerikanischen Sericinen (Melolonthinae) (p. 315-366).
  Machatschke, J. W. Eine neue *Anomala* aus Äthiopien (Rutelinae, Anomalini) (p. 249-254).
  Machatschke, J. W. Eine neue *Rhinyptia (Pararhinyptia)* aus Gabon (Rutelinae, Anomalini) (p. 280-283).
  Petrovitz, R. Neue Aphodiinae aus der orientalischen Region (p. 304-310).
CARABIDAE: Mandl, K. Bausteine zur Kenntnis der Familie Carabidae (p. 88-100).
CICINDELIDAE: Mandl, K. Neue Cicindelidae-Formen aus den tropischen Gabieten Afrikas und Süd-Amerikas (p. 290-303).
MICROPEPLIDAE: Nohel, P. *Micropeplus* species represented in the Frey Museum (p. 229-231).
TENEBRIONIDAE: Skopin, N. G. Revision der Tenebrioniden-Gattungsgruppe *Trigonoscelis-Sternoplax* (p. 104-185).
CANTHARIDAE: Wittmer, W. Zur Kenntnis der Gattung *Themus* Motsch. (p. 186-228).

—R. E. Woodruff

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NOTES ON THE ECOLOGY, DISTRIBUTION, AND TAXONOMY OF CERTAIN BUPRESTIDAE

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Abstract

Host and/or distribution data are presented for species in the following genera of Buprestidae: *Agrilaxia, Agrilus* (15 species), *Anthaxia, Chrysobothris, Mastogenius,* and *Ptosima.* It is recommended that *Mastogenius subcyaneus crenulatus* Knull be considered a full species in view of differences in morphology and larval host.

During the past several years, studies of members of the genus *Agrilus* (Hespenheide, 1969 and unpubl.) have produced a number of apparently new records of larval ecology and adult geographic distribution, both of *Agrilus* and of other members of the family Buprestidae. These are summarized below. All specimens are presently in the collection of the author.

Agrilaxia flavimanna (Gory). Specimens were reared from branches of *Quercus,* probably *stellata* Wang., North Carolina: 2 miles W of Wake Forest, Wake Co., IV-1967.

Agrilus abductus Horn. A single female collected at Clinton, Sampson Co., North Carolina, 17-V-1968 on *Cornus florida* L. is the first record for that state.

Agrilus arcuatus arcuatus (Say). A dead male was cut from a branch of *Quercus ilicifolia* Wang., New Jersey: 4 miles NE of Moorestown, Burlington Co., V-1967.

Agrilus cephalicus LeConte. Specimens were reared from *Cornus florida* L., North Carolina: Wake Forest, V-1966.

Agrilus crinicornis Horn. Specimens have been reared abundantly from a branch of *Fagus grandifolia* Ehrh., New Jersey: V-1967, 4 miles NE of Moorestown. A male was reared from *Quercus alba* L., 5 mi. ENE of Moorestown, V-1967. Fisher (1928) recorded the host as unknown.

Agrilus defectus LeConte. Several specimens were reared from branches of *Quercus,* probably *stellata* Wang., North Carolina: W. of Wake Forest, IV-1967. A male was reared from twigs of *Quercus alba* L., New Jersey: V-1967, 5 mi. ENE of Moorestown.

Agrilus diospyrioides Knull. Four specimens were reared from a branch of *Diospyros virginiana* L., North Carolina: Raleigh, IV-1967, confirming Knull's guess that this plant is the host. A dead female *Agrilus* dug from a branch of *Diospyros,* 5 miles ENE of Moorestown, N.J., is also probably this species.

Agrilus difficilis Gory. One specimen was reared from a large branch of *Gleditsia traicanthos* L., New Jersey: Merchantville, Camden Co., spring 1968. This appears to be the first record of the species from New Jersey and the first record east of the Alleghenies (Fisher, 1928).

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Agrilus fallax Say. This species has been reared abundantly from *Gleditsia triacanthos* L. from Merchantville, N.J. (Hespenheide, 1969) and from *Celtis occidentalis* L., Merchantville, and from *Celtis laevigata* Willd., VIRGINIA: Norfolk, spring 1968.

Agrilus geminatus (Say). Specimens were reared from branches of *Quercus marilandica* Muenchh., NORTH CAROLINA: W of Wake Forest, XII-1967, and from branches of *Quercus* sp., NEW JERSEY: 5 mi. ENE Moorestown, V-1966, and CONNECTICUT: East Willington, Willington Twp., spring 1970. Knull (1930) recorded *Quercus velutina* as a larval host; in addition to these rearings, adults are usually collected on the foliage of oaks. A specimen of *geminatus* was also collected 1 mi. NE Mohegan, Montville Twp., Conn., 6-VI-1972. The North Carolina and Connecticut records are new for these states.

Agrilus lecontei lecontei Saunders. This species has been reared in numbers from branches of *Celtis occidentalis* L., NEW JERSEY: Merchantville, and VIRGINIA: Winchester, Frederick Co., and from branches of *Celtis laevigata* Willd., VIRGINIA: Norfolk.

Agrilus masculinus Horn. This species was reared abundantly from branches of *Acer saccharum* Marshall and *A. platanoides* L., NEW JERSEY: Merchantville (Hespenheide, 1969). Four specimens were also dug or reared from *Gleditsia triacanthos* L. at the same locality. Specimens have been reared from *Acer saccharum,* CONNECTICUT: East Willington, and from *Acer negundo* L., NEW JERSEY: Princeton, Mercer Co., V-1966.

Agrilus osburni Knull. Six specimens were cut from a single branch of *Ostrya virginiana* (Miller) K. Koch in which they had died during emergence. The branch, containing 22 emergence holes, was collected in CONNECTICUT: Storrs, Mansfield Twp., VII-1972. This is the first published record of this species since its original description from 2 specimens collected in Ohio, as well as the first larval host record. The genitalia (figured by Knull, 1944) are very distinctive within the genus.

Agrilus paracelti Knull. Specimens fitting the description of this species have been reared in abundance from branches of *Celtis occidentalis* L., NEW JERSEY: Pennsauken, Camden Co., and VIRGINIA: Winchester. The relationship of this form to *Agrilus celti* Knull requires further study. The long series reared in New Jersey includes individuals with an entire vitta of pubescence on each elytron as well as some with virtually no pubescence except in the basal depressions of the elytra and a small elongate spot just above the middle; all intermediates are represented. The form of the genitalia also appears to vary within this species so as to include that figured for *paracelti* as well as that for *celti* (Knull, 1972, cf. Knull, 1945).

Agrilus putillus Say. This species was reared from both *Acer saccharum* Marshall and *A. platanoides* L., NEW JERSEY: Merchantville (Hespenheide, 1969). One specimen was reared from *Gleditsia triacanthos* L., spring 1968 at the same locality and is assumed to be an accidental host (see Hespenheide, 1969, for discussion of "overflow" host records).

Agrilus subcinctus Gory. Fisher (1928) recorded a series of specimens on poison ivy (*Rhus toxicodendron* L.); Knull (1932) recorded it as breeding in *Fraxinus pennsylvanicus* var. *lanceolata* Sarg. in Pennsylvania. I have taken a small series on ash (*Fraxinus* sp.), VIRGINIA: Stumpy Lake, Virginia Beach, and I have found *Agrilus* larvae in ash twigs, PENNSYLVANIA: Doylestown, Bucks Co., although I failed to rear adults. I have also seen borings and exit holes in dead twigs of poison ivy near Moorestown, N.J., which are certainly those of *Agrilus*.

Anthaxia cyanella Gory. This species was described from dark blue specimens, all of which on examination turn out to be females. These blue individuals have at times been assumed to be special female forms of *A. quercata* (e.g., Cobos, 1958), although there is also a female *Anthaxia* rather like the male of *quercata.* Between 30-IV and 19-V-1966, 6 males and 6 blue females of the *cyanella* type emerged from branches of *Cercis canadensis* L., collected at Wake Forest, N.C., on 12-IV. These males are quite different from the females and resemble the females of *quercata,* except that they lack the narrow oblique green stripe on the distal and marginal portion of the elytra and have a brighter green front (though less brilliant than that of male *quercata*); the pattern of bright green and dark on the thorax is also different between the two. The reared males are uniform among themselves and consistently different from *quercata* males, as are the females, and must, with the different host plant, represent a distinct species. The sexual dimorphism of *cyanella,* both in color and form (the male is narrower than the female), is one of the more striking cases known to me within the Buprestidae. The confusion of this species with *quercata* is due to the fact that the male of *cyanella* is intermediate in form and color between the male and female of *quercata.* Obenberger (1926) may have described the male as a distinct species, but I have not seen his types. Wellso (in prep.) will figure the genitalia of both species and discuss them further.

Anthaxia quercata Fab. A single male was reared from a branch of *Pinus rigida* Mill., MASSACHUSETTS: Marconi Memorial, South Wellfleet, Cape Cod, spring 1971. Many other emergence holes, almost certainly of this species, were seen in pine branches at this site and in Wake Forest, N.C. (in *Pinus taeda* L.). Although adults are virtually always collected on broad-leaved plants, especially oaks, the larval host appears to be pine. Numerous rearings from oak and other broad-leaved trees have never produced this species.

Anthaxia viridicornis (Say). This species has been reared from branches of the following hosts at the following localities: *Ulmus americana* L., NEW JERSEY: 1 mi. E of Merchantville, Camden Co., and 1 mi. N of Mount Laurel, Burlington Co., III & IV-1966; *Carya illinoensis* (Wang.) K. Koch, NORTH CAROLINA: 2 mi. NW of Knightdale, Wake Co., and *Carya* sp. Wake Forest, IV-1967; *Carya ovata* (Mill.) K. Koch and *Carya,* probably *glabra* (Mill.) Sweet, CONNECTICUT: Willington Twp. and *Carya* sp., Hall's Pond, Eastford Twp., 1971. I can detect no morphological differences between individuals reared from elm and those from hickory.

Chrysobothris sexsignata (Say). Four specimens were reared from branches of *Betula nigra* L., NORTH CAROLINA: Wake Forest, IV-1966. A single specimen was reared from a branch of *Gleditsia triacanthos* L., NEW JERSEY: Merchantville, spring 1969. Neither plant is recorded by Fisher (1942) as a host of this beetle.

Mastogenius subcyaneus (LeConte). Specimens were cut and reared from twigs of *Quercus,* probably *palustris* Muenchh., NEW JERSEY: Merchantville, spring 1966 (see discussion under next species).

Mastogenius crenulatus Knull. NEW STATUS. Specimens of this form were reared in small numbers from branches of *Cercis canadensis* L., NORTH CAROLINA: Wake Forest, IV-1966. In view of the difference in larval host plant, the largely sympatric distributions, and the differences in adult morphology, summarized below, it seems advisable to consider *subcyaneus* and *crenulatus* distinct species, rather than subspecies. The following table summarizes these differences.

	***subcyaneus* Lec.**	***crenulatus* Knull**
larval host	*Quercus*	*Cercis*
front	slightly, broadly convex with shallow medial channel	strongly convex with broad, deep medial channel
thorax	punctate, glabrous, lateral margins only slightly arcuate	rugose, pubescent, lateral margins strongly and abruptly arcuate
elytra	deep blue-violet reflections	black

Ptosima gibbicollis (Say). Two specimens were cut from branches of *Cercis canadensis* L., NORTH CAROLINA: Wake Forest, 12-IV-1966. These were adults that appeared to be overwintering: I know of no similar records of overwintering in this fashion by buprestids. *Cercis* has recently been reported by Knull (1970) as the host of this species.

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LARVAE OF THE FAMILIES OF COLEOPTERA: A BIBLIOGRAPHICAL SURVEY; ADDENDA ET CORRIGENDA I.

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Abstract

This work supplements Cornell's bibliographical survey of coleopterous families by adding 53 recent references on 53 families, including several records of described families or larvae—both living and fossil—that were previously omitted.

Introduction

In the September 1972 issue of the **Coleopterists Bulletin** (26: 81-96) J. F. Cornell presented a bibliographical survey of 183 recent papers and tabular summary of 7 well-known English language contributions on larvae of the families of Coleoptera which should be useful to every coleopterist. In order to improve the existing classification of Coleoptera in any group and at any level it would be necessary to study larvae, fossils, internal anatomy, serology, etc. A few important additions and corrections to Cornell's survey are given here, and the primitive or derivative alternatives of the distinguishing characters of larvae (and adults) of the families (and other groups) of Coleoptera are summarized elsewhere (Abdullah, 1971).

In the following list the numbers in parentheses refer to references in the terminal bibliography.

Additions and Corrections

Acanthocnemidae (21); Anthicidae (2, 25); Boganiidae (44); Bostrichidae (16); Byturidae (4, 7); Carabidae (26, 27, 28); Cavognathidae (18, 42); Cerambycidae (35, 36); Chaetosomatidae (21); Cicindelidae (28); Cisidae or Ciidae (34); Cleridae (21); Coccinellidae (7a, 14, 30, 31, 32, 33, 40) (Ashrafi, S. H. 1966-1968. Biology and morphology of the larva of bean beetle, *Epilachna chrysomelina* Fabricius. Zool. Dept. Publ. Karachi Univ., Pakistan); Curculionidae (50); Derodontidae (15); Diphyllidae (4, 7); Dytiscidae (13, Baltic amber); Erotylidae (41); Georyssidae (12); Glaphyridae: Crowson (210) in the 1967 reprint; Helotidae: #138 of Cornell; Hybosoridae: Crowson (210) in the 1967 reprint; Hydrophilidae (9, 10, 11, 12, 13); Hydroscaphidae (12); Lamingtoniidae (45, not known); Languriidae (43, 46); Lophocateridae (21); Lyctidae (16, a subfamily of Bostrichidae); Melandryidae (51); Melyridae (21); Micromalthidae (37, 39); Mycteridae (24, now in Hemipeplidae); Nosodendridae (15); Noteridae (5, 38 [fossils]), Crowson (201) in the 1967 reprint; Peltidae (19, 21); Perimylopidae (52, 53); Perothopidae: ? Böving & Craighead, 1931, pl. 81, E-G, 'unidentified larva', according to Crowson (211) in the 1967 reprint;

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[2] Now: 146 Sherwood St., Nottingham NG1 4EF England.

Phloeostichidae (42, 44); Phloiophilidae (21); Phycosecidae (21); Propalticidae (23); Ptilodactylidae (8); Rhipiceridae (22); Sarothriidae (15); Scarabaeidae (29); Scolytidae (48, 49, evidence in favour of a subfamily of Curculionidae status); Sphaeriidae (12); Staphylinidae (47); Tenebrionidae (1, but antennae are 3-segmented, first concealed within basement membrane and overlooked), 6; Tetratomidae (17); Thorictidae (15); Torridincolidae (12); Trogossitidae (21); for similar information on fossils, see Abdullah, 1973 a (#5). This work should be read in conjunction with Cornell (1972).

Acknowledgments

I wish to record my thanks to the following: Dr. Walter Forster, Director and his German staff for space and requisite facilities in Munich; Dr. K. U. Clarke of the Nottingham University, Zoology Department for his kind interest; fellow-coleopterists of the world for presenting me their reprints or separates; my wife, Abida Abdullah, for her assistance; and the officers of the German Humboldt Foundation for a senior lecturer's fellowship award.

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Number 11 THE COLEOPTERISTS NEWSLETTER **December, 1973**

EDITOR: CHARLES W. O'BRIEN, UNIV. P. O. BOX 111, FLORIDA A AND M UNIVERSITY, TALLAHASSEE, FL 32307

WAU ECOLOGY INSTITUTE

The Institute has renewed its request for donations. Grant reductions and the decline of the U. S. dollar have hit us hard, though we are making progress towards self support (a Bishop Museum subsidy goes to pay off existing properties and other expenses). Dormitories are now being built to house visiting classes from colleges and universities in the Territory of Papua and New Guinea. We hope to finance these with half coming from local corporations and half from gifts from the U. S. (the latter are over half subscribed). Dormitories will be open to visiting scientists as well. The unique environments in a wide altitude range make Wau a very special place for tropical ecology and other types of field work.—J. L. Gressit, Wau Ecology Institute, P. O. Box 77, WAU, Territory of Papua and New Guinea.

ADDRESS CHANGES

Nelson W. Baker, 69-990 Papaya Lane, Cathedral City, Calif. 92234.
Jack C. von Bloeker, Jr., Director, Frank Stephens Memorial Research Station, P. O. Box 1169, Green Valley, Arizona 85614.

RECENT INFORMATION ON MEXICAN COLLECTING PERMITS

Round table discussions concerning collecting, collections, and the legal, ethical, and administrative aspects of same in Mexico were held October 29-31, 1973 in Mexico City. I was present as the guest of the Museo de Historia Natural de la Ciudad de Mexico, the Consejo Nacional de Ciencia y Technologia (CONACYT), and the Sociedad Mexicana de Historia Natural. Numerous prominent Mexican biologists presented their views concerning these topics and the problems associated with them, and there were 2 invited guests from the United States, Dr. Roger McVaugh, Director of the University of Michigan Herbarium, and myself.

One of the major purposes of these open meetings was to determine the extent of interest in developing a Mexican "National Museum of Natural History". It was evident that this has the support of many prominent biologists but seems to lack the grass roots support necessary for success. I think we should support such a museum if it can be authorized officially by the Mexican government. Without such support it has little chance of success. I will try to keep the Coleopterists Society informed of further developments.

The legal aspects concerning the protection of plants and animals in Mexico were discussed in some detail. Several laws affecting entomologists are on the books. The original purpose of these laws was to protect natural resources in Mexico and to reduce the serious depredation of these resources by unscrupulous commercial collectors of plants and animals (especially birds, reptiles, and mammals). Exploitation by collectors of endangered groups of plants (orchids and cactus) and animals have made it tougher for everyone, including reputable scientists. The more pertinent federal laws are on hunting (1952), forestry (1960), and fisheries (1972). As the result of these laws, several agencies have the responsibility for policing and regulating collecting in Mexico.

In 1947, 1962, and 1972, CONACYT was authorized to plan, program, coordinate, orient, systematize, promote, and pursue activities related to science and technology. This includes relationships of foreign scientists who wish to collect in Mexico. Because of these authorizations and others within the law, CONACYT has been issuing collecting permits and should be approached in the future. Write to Dr. Enrique Martín del Campo, Consejo Nacional de Ciencia y Tecnologia, Insurgentes Sur 1677, Mexico, 20 D.F., Mexico, and include the following information: the types of animals (insects) to be collected; the inclusive dates of your trip and the areas to be visited and collected and special collecting techniques, if any, that will be used. It would be well to point out that no endangered species will be collected and that representative samples of material collected will be sent to Mexican museums when they have been processed [If you have no previous contacts to give such material to, it would be welcomed by Dr. Alfredo Barrera, Director, Museo de Historia Natural de Chapultepec, Nuevo Bosque de Chapultepec, Mexico, D. F., where it will be put to good use and carefully handled]. Be sure to indicate your affiliation with a university or museum, and if you lack such affiliation, you can probably expedite receipt of your permit by including the name(s) of well-known scientists willing to recommend you if necessary.

The major emphasis on permit issuance is to reduce or eliminate exploitation by commercial collectors. Our Society's cooperation in this effort is urgently solicited, and we will benefit as well if activities of such collectors can be halted or drastically reduced.

The permits issued by CONACYT are free and available to all reputable scientists, and their use is included in Mexican law.

(Continued on p. 200)

A NEW WEEVIL GENUS FROM AMERICA NORTH OF THE ARCTIC CIRCLE AND NOTES OF FOSSILS FROM PLIOCENE AND PLEISTOCENE SEDIMENTS (COLEOPTERA: CURCULIONIDAE)*

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Abstract

Vitavitus thulius Kissinger is described as a new genus and species from a unique specimen from Canada north of the Arctic Circle. The genus occurs as fossils in sediments of middle Pliocene to late Pleistocene age. The new genus is near *Lepidophorus* Kirby; both are assigned tentatively to the subfamily Hyperinae. *Alophus* Schoenherr is assigned to Leptopiinae (= Alophinae).

Introduction

The genus described herein is of considerable importance from a paleoecological viewpoint, because it represents a significant change in the fauna of Alaska and Alberta during the Pleistocene period. Fossils representing the genus occur in sediments ranging in age from 5.7 million to 27,000 years before the present (BP) according to Matthews (1972). Late Pleistocene assemblages in which it occurs also contain fossils of *Lepidophorus lineaticollis* Kirby; whereas, a late early Pleistocene assemblage from western Alaska (Cape Deceit Formation—Matthews, MS) contains an abundance of fossils representing the new genus, but none of *Lepidophorus*. Younger sediments contain only *Lepidophorus*, indicating the possibility that it replaced the new genus as time passed. Only 1 specimen of the extant species of the new genus is known. At the present time *Lepidophorus lineaticollis* Kirby occurs in Siberia, Alaska, and northern Canada; other species of *Lepidophorus* occur from Alaska into western North America, especially at high elevations.

The taxonomic placement of the new genus is difficult, because comparative information about possible relatives has not been published. In addition the possible relatives are placed in various subfamilies which are not yet adequately defined. The genus is tentatively assigned to Hyperinae.

VITAVITUS Kissinger, New Genus

Diagnosis: Mandible not scarred; frons with small lateral prominence above anterior margin of eye, not narrower than base of rostrum; prothorax with small postocular lobe bearing short setae; elytra 10 striate; female sternum 8 with basal strut longer than apical expansion; female genital tube short, wider than long; coxite sclerotized, bearing long, narrow stylus.

Additional characters as follows: Proventriculus with 8 sclerotized plates bearing setae (type II of Kissinger, 1963). Mandible with (approximately) 3

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*Technique and terminology of this paper follow Kissinger (1970).

small setae on basal lateral aspect; lateral margin from base to apex produced into narrow flat margin only in basal 1/2. Scape extends slightly beyond anterior margin of eye; with broad, decumbent scales and suberect, coarse setae. Elytral stria 10 finer than striae 1-9; basal margin vertical, receiving base of prothorax; humeri present, rounded; intervals flat, with broad imbricate scales. Flight wings nonfunctional. Scutellum not visible. Metepisternal suture complete. Suture between sterna 1 and 2 shallower than next suture, broadly, strongly arcuate anteriorly in median aspect. Tibiae 1-3 lacking distinct mucrones (not visible under 100 X). Tarsal segment 3 broadly bilobed, pubescent ventrally. Tarsal claw free. Female genital tube lightly sclerotized; coxite bearing stylus approximately 160 microns long, coxite and stylus bear setae 90 to 180 microns long.

Type-species: *Vitavitus thulius* Kissinger, new species. Name based on Latin, *vita,* for life and, *avitus,* for ancestral.

Vitavitus thulius Kissinger, NEW SPECIES

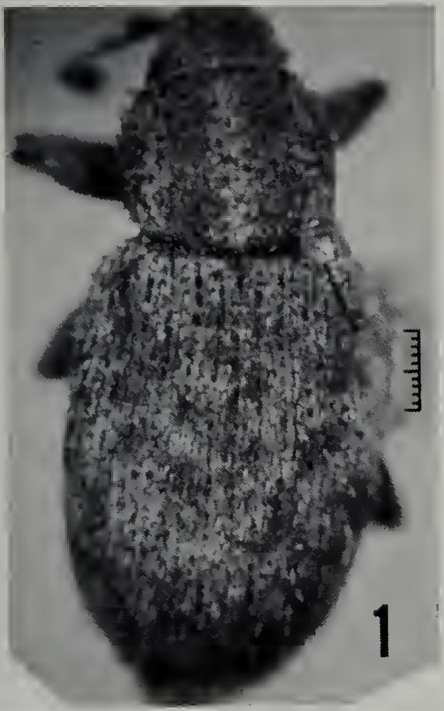
Described from 1 specimen. HOLOTYPE: Female, labelled, "Bernard Harbour, N. W. T. (68.48° N, 114.42° W); July 6, 7, 1913; Canadian Arctic Expedition, F. J.;" [Canadian National Collection].

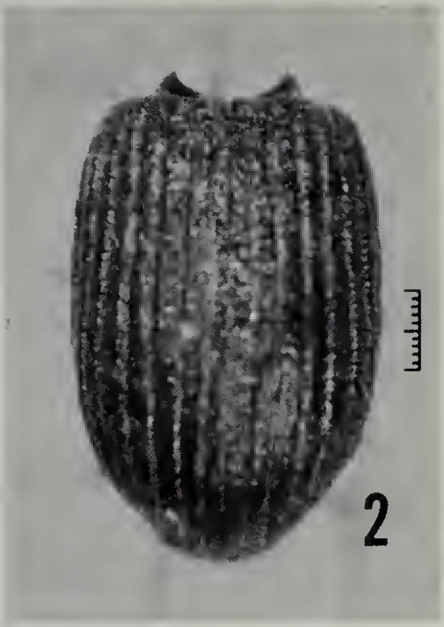
(Fig. 1, 5-8) Length: 2.75 mm; width; 1.32 mm. **Vestiture**: Head, prothorax, and elytra clothed with dense light gray scales, light tan scales arranged to form moderately broad sublateral stripe on dorsal surface of prothorax and sparse, small irregular spots on elytra. Prothorax and elytra with sparse, coarse, suberect, blunt setae about 0.06 mm long; setae mostly in uniserial arrangement on elytral intervals. **Rostrum:** Dorsal surface flat, with shallow lateral impression broad near base and narrowing apically, more or less concealed by vestiture; laterally with scrobe with well defined dorsal margin extending to near eye. **Prementum:** Trapezoidal in shape, lacking setae on ventral surface, with one seta 0.04 mm long on sublateral dorsal surface; segment 1 of palpus quadrate, bearing on lateral surface 1 large and 1 small seta (large seta broken off near base on specimen); segment 2 ovoid, with one seta 0.4 mm long on lateral aspect; segment 3 cylindrical, with 1 lateral punctate sensillum and 5 nodiform sensillae on apex. **Prothorax:** In profile dorsal surface more convex basally, flattened apically. **Tibia 3:** Apical comb composed of a single row of setae which gradually increase in length from anterior to posterior region of comb, longest seta about 50% longer than shortest; with minute prominence, perhaps analogous to mucro, on apical anterior margin with peculiar seta which is broad at base and abruptly narrowed near apex; this structure not longer than adjacent setae of apical comb and not visible under dissecting microscope. **Female sternum 8:** Apical margin of apical expansion with short, uniformly placed setae. **Female genital tube:** Apical region of coxite bears various setae (not all illustrated on figure); in dorsal lateral aspect with 2 or 3 large setae; stylus with at least 2 setae located near base. **Spermatheca:** Ramus short; nodulus subcylindrical and projecting some distance above structure; cornu gradually narrowed apically; spermathecal duct membranous; spermathecal gland broadly circular in outline, duct between gland and nodulus short. Name based on Latin, *Thule,* for farthest north.

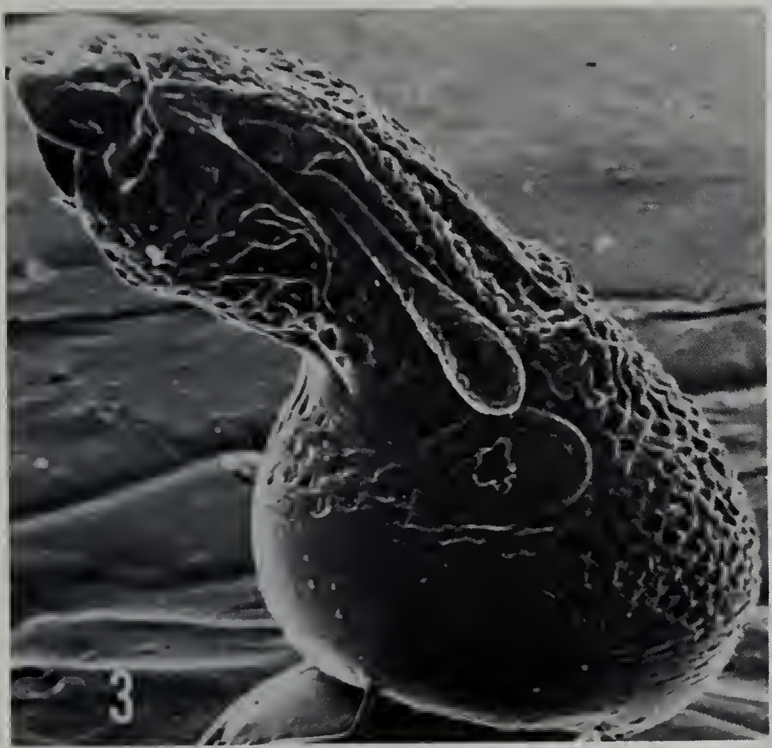
ASSOCIATED MATERIAL

Fossil material from 4 sites represents either *Vitavitus thulius* or a very similar species. The fossils are mostly disarticulated heads, pronota, and elytra which have lost their vestiture. Because the remains are denuded, comparison with the unique recent specimen is excessively difficult. In my opinion the variation seen in the fossil specimens might be expected to occur within 1 species.

Site 1. Lava Camp Mine, Inmachuk River Valley, northern part of Seward Peninsula, Alaska, near the Bering Strait; see Hopkins *et al* (1971) for details about the Pliocene flora and insect fauna of this collection. Apparently the assemblage represents a coniferous, flood-plain forest community similar to







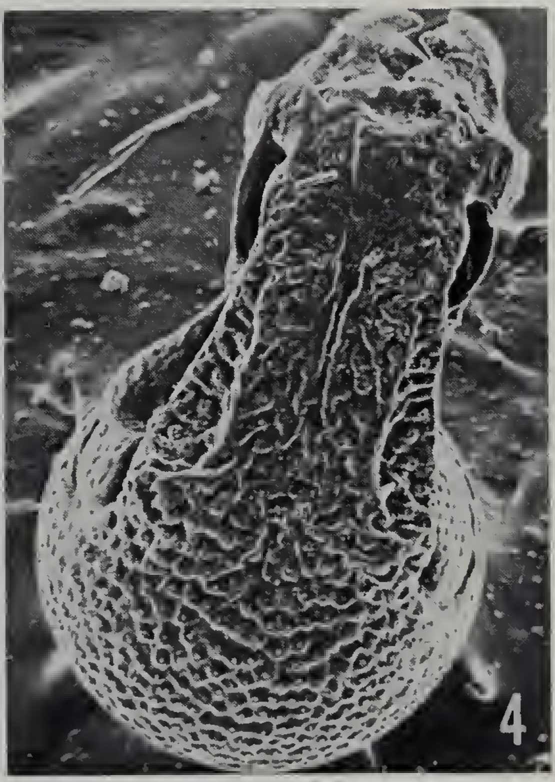


Fig. 1. *Vitavitus thulius* Kissinger, dorsal view of holotype, reference line 0.34 mm.

Fig. 2-4. *Vitavitus* cf. *thulius* Kissinger, Cape Deceit Formation: 2) dorsal view of elytra, reference line 0.32 mm; 3) scanning electron micrograph of lateral view of head; 4) same of dorsal view of head.

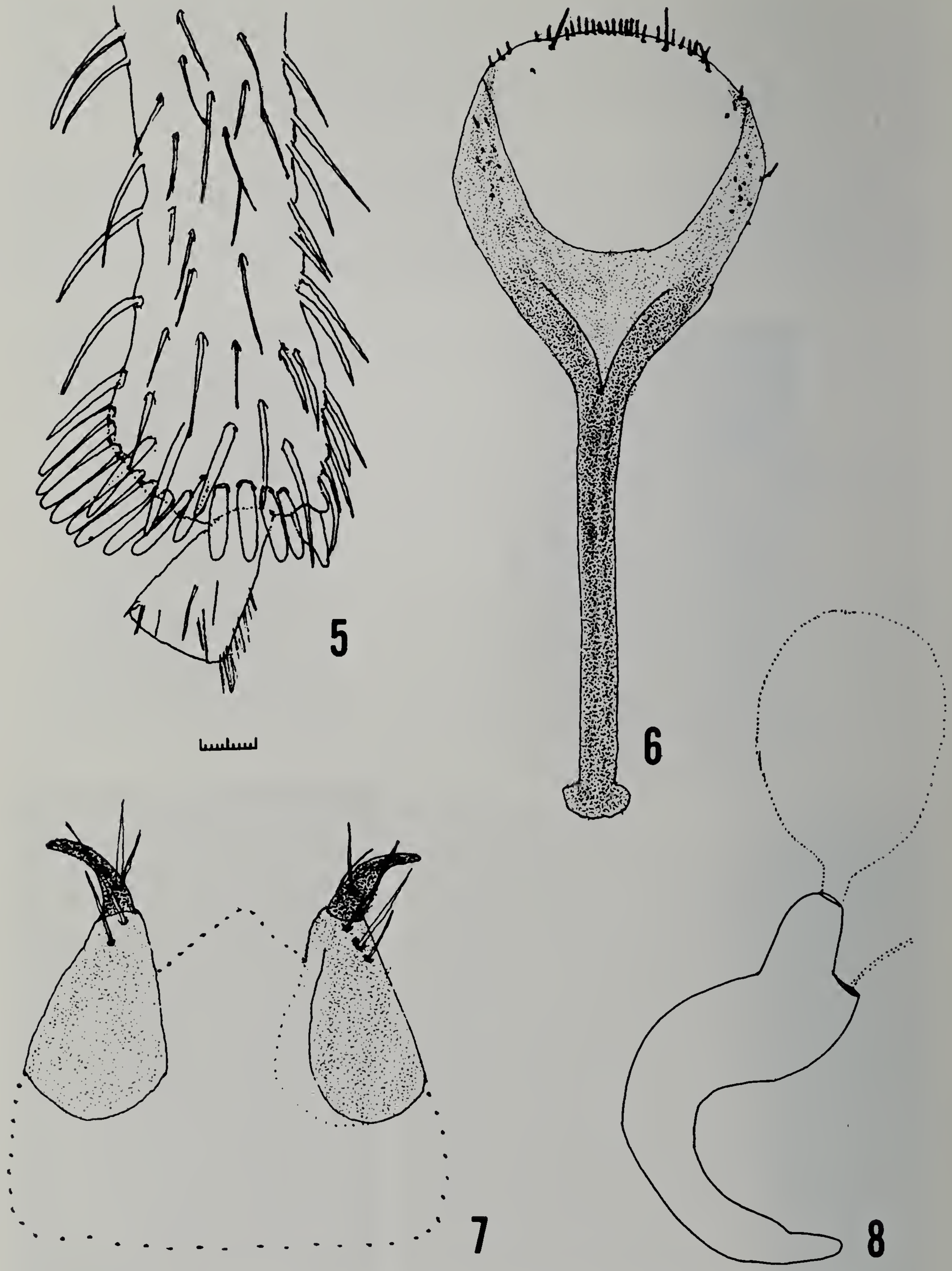


Fig. 5-8. *Vitavitus thulius* Kissinger, holotype. 5) lateral view of apex of left tibia, anterior surface to the right, reference line 0.046 mm. 6) ventral view of sternum 8, reference line 0.09 mm. 7) dorsal view of apical region of female genital tube, reference line 0.09 mm. 8) spermatheca and spermathecal gland, reference line 0.046 mm.

present-day forests in southeastern Alaska and coastal British Columbia. The fossil-bearing sediments are covered by basaltic lava dated by the potassium-argon method at 5.7 million years BP (Hopkins *et al,* 1971). Two heads and a prothorax fragment of *Vitavitus* were found. The heads have the dorsal surface of the rostrum at the base more strongly depressed along the median line than the recent specimen; also the lateral prominence of the frons is more strongly developed. In the next collection (Camp Deceit) is a series of heads, some of which have the rostrum depressed at the base as in the Lava Camp specimen. In view of this it is possible that the 2 types of heads represent extremes of variation of *V. thulius.*

Site 2. (Fig. 2-4). Cape Deceit Formation exposed near Deering, north coast of Seward Peninsula, Alaska. Sediments from this site contain fossil insects, plant macrofossils, and pollen spectra which indicate tundra conditions (Guthrie and Matthews 1971; Matthews MS). A large series (about 290) of isolated heads, pronota, and elytra of *Vitavitus* was found in unit 2 of the Cape Deceit Formation which is dated at 400,000 to 700,000 years BP (Matthews MS).

One outstanding specimen is an articulated mesothorax, methathorax, and abdomen. On the basis of this specimen I am fairly confident that all of the fragments of *Vitavitus* from the sample represent *V. thulius.* The following comparisons are made with the recent specimen of *thulius.* Female genitalia are present in the fossil. Sternum 8 is similar (the central membranous portion of the apical expansion is lost) but is comparatively shorter both in length of strut and apical expansion; however the ratio between the length of these 2 parts is similar. The stylus from 1 coxite is present but apparently was detached when the specimen was dissected; the shape and size are similar. The spermatheca is present and is similar; the cornu is somewhat more elongate, but this can be a common variation within a species. The sculpture of the thoracic and abdominal sterna are similar. The elytra are comparatively longer (mean 2.285 mm, S.D. 0.133); the length of the Bernard Harbour specimen (1.90 mm) is within 2.89 standard deviations of the mean. The width of the elytral intervals on the denuded fossil specimens superficially appears greater, but actual measurements show no significant difference here. An estimate of the distance between suberect setiform scales on the intervals of the denuded specimen was made by determining the distance between the major punctures, which presumably bore such scales, in a row down the center of an interval; spacing is more or less similar. A small area of the elytra of the Bernard Harbour specimen was abraded to remove the scales; the denuded surface of the elytral intervals was similar. The profile of the elytra in side view is similar.

One fossil fragment of the base of a left elytron bears a few suberect scales similar to those seen in *thulius.*

A major variation noticed in the head of the fossils is the presence of a more or less well defined depression on the dorsal median surface at the junction of the frons and rostrum. While it is not possible to discount entirely the importance of the difference, such individual variation does occur in other weevil species.

Site 3. Old Crow River, northern Yukon Territory. J. V. Matthews (G. S. C., Ottawa) is in the process of studying this assemblage. Preliminary evidence indicates that it represents a flood-plain environment within a region of open spruce forest. Some fossils of tundra insects are present in the assemblage.

Carbon 14 dates suggest that the age of the assemblage is greater than 40,000 years BP (Matthews 1972). Remains of *Lepidophorus lineaticollis* Kirby are present in this assemblage along with 4 fragments of *Vitavitus*—a head, right and left elytron, and a pronotum. No significant variation was noticed.

Site 4. Watino, north central Alberta (Westgate, *et al.* MS). The fossil assemblage represents a flood-plain containing ephemeral ponds. Age of the unit containing *Vitavitus* fossils is approximately 27,400 years BP (Matthews 1972). *Lepidophorus lineaticollis* Kirby fossils and 6 heads, 2 pronota, and 1 left elytron of *Vitavitus* were found in the assemblage. The *Vitavitus* heads vary from being virtually flat on the dorsal surface at the base of the rostrum (as in the recent specimen of *thulius*) to having a deep median depression which is accentuated by a transverse depression across the rostrum base with an accompanying reduction in the depth of the lateral basal sulcus on the dorsal surface of the rostrum.

Conclusions

The recent specimen appears to be significantly smaller than the fossil remains; this is especially evident in the length of the elytra as described above. Such a difference in size has developed between 2 isolated populations of *Ophryastes desertus* (Horn); the population occurring in Death Valley is significantly smaller than individuals occurring near the Salton Sea (Kissinger 1970). Thus, size difference alone is not a sufficient criterion of species distinctness; it may indicate that recent selection pressure on *thulius* favored survival of smaller individuals.

Other significant differences between the fossils and the holotype involve the distinctness of the lateral sulci on the base of the rostrum and the development of a median depression near the base of the rostrum. Because a few individual heads, with especially distinct lateral sulci and a deep median depression, occur along with individuals on which these traits are similar to *thulius,* I am inclined to consider them as extremes of 1 species. At any rate the fragmentary fossil remains do not offer any clear cut evidence that more than 1 species is involved; hence all are referred to *V. thulius.*

Systematic Notes

A very close relative of *Vitavitus* is *Lepidophorus* which past workers (Klima 1935) placed in Alophinae. Wilcox and Baker (1935) showed that various genera formerly assigned to Alophinae possess deciduous processes on the mandible and thus should be assigned to Leptopiinae (Kissinger 1964). Unpublished studies indicate that *Alophus* Schoenherr also possesses mandibular processes and should be assigned to Leptopiinae.

Neither *Lepidophorus* nor *Vitavitus* possess mandibular processes. The problem arises as to which subfamily the genera should be assigned. Of the subfamilies of Curculionidae occurring in North America the ones which might be related are as follows, together with some characters that distinguish the subfamily from *Vitavitus.* Cylindrorhininae have a deep lateral scrobe on the rostrum and the tibial mucro tends to have an acute spur on the ventral surface. Thecesterninae have a peculiar medial emargination on front margin of the prosternum which receives the rostrum and tibia 3 is both mucronate and uncinate. Cleoninae tend to have the rostrum comparatively longer and more slender and either the tarsal claws are connate or tibia 3 is uncinate. The Hyperinae are similar in having eyes which are transversely oval in outline, the rostrum is comparatively short and stout; and (at least in the species examined) sternum 8 of the female lacks a basal strut. It must be admitted that my placement of *Lepidophorus* and *Vitavitus* in Hyperinae is tentative. Much comparative study must be done, involving the subfamilies mentioned here, as well as others which are similar but do not occur in North America.

Lepidophorus exhibits the following differential characters in contrast to those described for *Vitavitus*. Mandible with 2 large setae in addition to a small one, lateral aspect of mandible with comparatively broader flat margin; scape extends beyond middle of eye; frons lacking tubercle over dorsal margin of eye (a tuft of setiform scales may be present here); frons narrower than base of rostrum; prothorax usually lacks postocular lobes but these may be present (*lineaticollis* Kirby); prothorax usually lacks postocular vibrissae but these may be present (*lineaticollis* Kirby and *alternatus* Buchanan); tibiae 1-3 may be mucronate; female sternum 8 lacks basal strut; female genital tube distinctly longer than wide, coxite not apparent, lacking stylus and setae.

A dissection of *L. lineaticollis* Kirby indicates that the genital tube is a lightly sclerotized tube which possibly is not extended from the body during oviposition. Observation of living specimens is necessary to confirm this point. Another observation of interest is that the dimensions of the tube are about 1.2 by 0.6 mm; the tube is roughly cylindrical. An egg within this specimen measured about 1.3 by 1.0 mm. Even after making allowances for changes in size and shape during the treatment of the specimen with KOH, one can imagine that the egg laying process in this species must be a mighty feat.

Fragments of *Lepidophorus lineaticollis* Kirby can be distinguished from those of *Vitavitus thulius* as follows. Head: rostrum with dorsal margin of scrobe not sharply defined and not extending to near eye; rostrum lacks basal lateral sulcus; frons lacks lateral prominence over eye and is narrower than base of rostrum; these differences are easily detected. Prothorax: postocular lobes are present but are not as prominent, this is a difference that may be hard to detect; in profile the dorsal margin is more evenly convex and is not flatted apically. Elytra: average length is greater (3.09 mm for *lineaticollis* versus 2.28 mm for *thulius*); the intervals are flatter and the striae comparatively more shallow. I have not seen fossil remains of *lineaticollis* and so can not be more specific.

Acknowledgment

I am indebted to Dr. John V. Matthews for calling my attention to the recent specimen described herein, for supplying fossil material from 4 sites for study, for supplying 2 scanning electron micrographs used in this paper, and for his aid and encouragement during the preparation of this paper. Miss Rose Ella Warner loaned for study 4 specimens of *Lepidophorus lineaticollis* Kirby from the United States National Museum.

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COLEOPTERISTS NEWSLETTER

(Continued from p. 192)

Allow plenty of time for more than one exchange of mail when you write for a permit. You may be asked for more information. By requesting permits we emphasize our desire to cooperate with our Mexican colleagues. My personal experience has demonstrated that they are very willing to cooperate and aid visiting foreigners. I was able to collect in the vicinity of Mexico City for 7 days on my recent trip, and I spent 6 of those in the field as the guest of 3 different entomologists who willingly used personal vehicles and their own time to take me collecting. Their generosity was typical of earlier experiences in Mexico, and I confess to a bias in favor of full cooperation on both sides for more mutually profitable field work and scientific endeavors.—Charles W. O'Brien.

DISCOVERED! A NEW COLLECTING PARADISE

Bear Mountain Ranch just north of Silver City, New Mexico is a 200 acre guest ranch owned by the McCormicks. There are forests and meadows adjacent to the Gila National Forest. It is an upper Sonoran region, but a few miles north one finds Canadian zone forest and a few miles south lower Sonoran. It is in part similar to the Cave Creek area of the Chiricahua Mountains in Arizona and in part quite different. I am interested in exchanging beetles and will send a list on request.—Rudolph Lenczy, 126 Los Robles, Green Valley, Arizona 85614.

* * *

(continued from inside front cover)

departments, provinces, parishes, and/or counties listed. Dates are listed by day, month (in Roman numerals), and last 2 digits of the year. Listing of ecological data is encouraged. Location of specimens should be shown in brackets; if the data is extensive these should be abbreviated as shown and the abbreviations listed in the text.

Any article concerning Coleoptera will be considered. Descriptions of new taxa must contain keys (or be correlated with existing keys) and illustrations. All manuscripts should be typed on 8½×11" opaque white paper with 1 inch margins. They should be typed on one side only and double spaced throughout (including title, footnotes, tables, figure legends, and references). All scientific names should be underlined. Use the following order: title, author, author's address, abstract, body of text, references cited, and figures. All footnotes, tables, and figure legends should be provided on separate sheets and double spaced. Indicate approximate figure and table locations in pencil in the margin of the manuscript.

An abstract should be a concise statement of the facts presented, not *that* they are presented (e.g. list names of organisms, not just that they were discussed or described as new). These abstracts are the key to how your article will be cited in the abstracting journals and should be carefully written.

THE COLEOPTERISTS SOCIETY

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Notices to appear on this page are a free service to members and subscribers. Such copy will be limited to the back page, the older notices being moved up and replaced with the newest ones at the bottom. The editor reserves the right to reword such notices for brevity, consistency, and clarity.

PYROCHROIDAE: Building world-wide reference collection. Will purchase or exchange for other Coleoptera. Desire all life stages, rearing data, observations, etc.; correspondence invited. Daniel K. Young, Dept. Ent., Michigan State University, East Lansing, MI 48823.

HYDRAENIDAE (Limnebiidae): Revising genera ***Hydraena*** and ***Limnebius*** for Western Hemisphere. Request loan of adults and/or larvae. Philip D. Perkins, Dept. Entomology (Coleoptera), National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560.

WANTED: One copy of ***Biologia Centrali-Americana,*** Coleoptera, Vol. II part 2. T. W. Taylor, 8529 Norwood Place, Rosemead, California 91770.

CARABIDAE: Dr. Gianluigi Alzona, c.so G. Ferraris 108, 10129-TORINO (Italy) would like to exchange ***Carabus, Calosoma, Cychrus*** in U.S.A., Canada, India, Middle East, U.S.S.R., China.

HYDROPHILIDAE: Presently revising the genus ***Anacaena*** of the world. Request loan of any available material. Jarrett L. Cross, Entomology Department, Smithsonian Institution, Washington, D.C. 20560.

WORLD RESEARCH DIRECTORY: Richard L. Jacques, Jr. and Ross H. Arnett, Jr. are preparing a world list of current research projects on Coleoptera. A volume will be published as a companion to the recently published "Directory of Coleoptera Collections." Anyone wishing to have a research project listed should write to R. L. Jacques, Jr., Dept. of Biology, Fairleigh Dickinson University, Rutherford, N.J. 07070.

SCARABAEIDAE: Studying myrmecophilous and termitophilous Aphodiinae. Request loan of New World material especially. Will sort from general scarab collections or from light trap samples. Robert E. Woodruff, Fla. Dept. Agr., P. O. Box 1269, Gainesville, FL 32601.

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FREE PUBLICATION: If you are not now receiving "Progress Reports", the newsletter of the North American Beetle Fauna Project, send your name, address, and interest in beetles statement to: Dr. R. H. Arnett, NABF Project, Dept. Biol., Siena College, Loudonville, NY 12211.

FOR SALE: Used insect boxes of various types and sizes and unit pinning trays for Cornell drawers and Calif. Acad. drawers. Write for specifics to R. E. Woodruff, 3517 N.W. 10th Ave., Gainesville, FL 32601.

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COLYDIIDAE: Building up worldwide collection. I want to buy or exchange other Coleoptera. Also interested in immature stages and publications on this family. Horst D. Matern, 5000 Koeln 41, Lotharstr. 34, Western Germany.

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PSEPHENIDAE (including EUBRIINAE, EUBRIANACINAE, and PSEPHENINAE): Revising the family in the Western Hemisphere. Request loan of any material from the New World. Dr. Harley P. Brown, Zoology Dept., Univ. of Oklahoma, 730 Van Vleet Oval, Norman, Oklahoma 73069.

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